United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Kansas Agricultural
Experiment Station

Soil Survey of Cheyenne County, Kansas

How To Use This Soil Survey

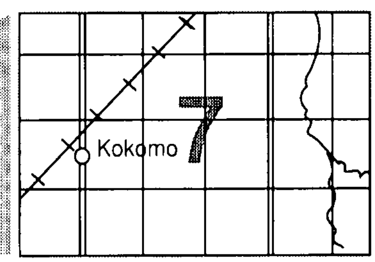
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

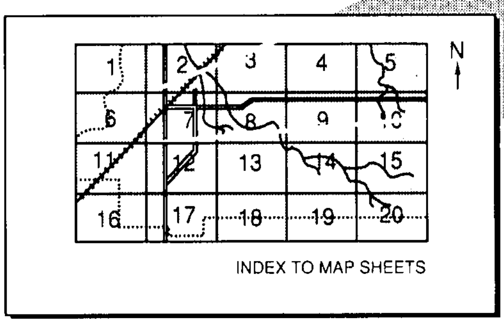
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



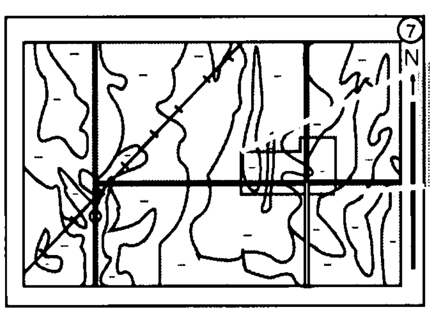
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

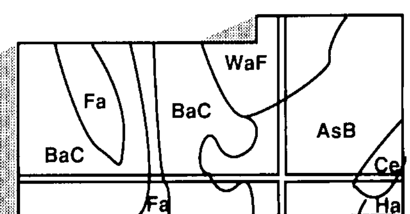


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Cheyenne County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: An area along the South Fork of the Republican River.

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Issued June 1989

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Foreword

This soil survey contains information that can be used in land-planning programs in Cheyenne County, Kansas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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State Conservationist
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Soil Survey of Cheyenne County, Kansas

By Vernon L. Hamilton and Donald A. Gier, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Kansas Agricultural Experiment Station

General Nature of the County

CHEYENNE COUNTY is in the northwest corner of Kansas (fig. 1). It has a total area of 653,357 acres, or about 1,021 square miles. In 1986, it had a population of 3,633. St. Francis, the county seat, had a population of 1,608. Bird City, which is in the eastern part of the county, had a population of 561.

Cheyenne County is in the Central High Tableland major land resource area. The soils on uplands are generally deep, friable, silty, and nearly level or gently sloping. Steeper areas are along the major drainageways. Loamy soils on stream terraces are along the South Fork of the Republican River and along the Arikaree River. Elevation ranges from about 3,800 feet above sea level at several points along the southern border, in the southwestern part of the county, to about 3,000 feet in an area along the northern border where the South Fork of the Republican River leaves the county. The county is drained by the Arikaree River, Beaver Creek, Little Beaver Creek, the South Fork of the Republican River, and their tributaries (fig. 2).

The economy of the county is based primarily on farming and ranching. Wheat is the main dryland crop. Grain sorghum and corn are the main irrigated crops.

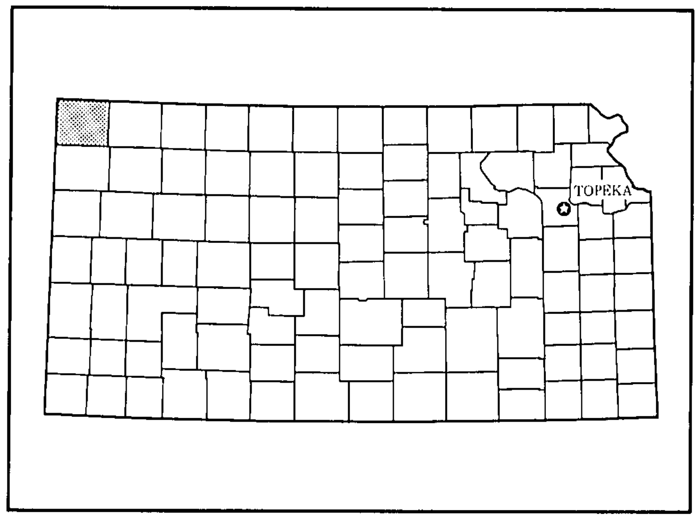

Figure 1.—Location of Cheyenne County in Kansas.

Climate

Prepared by L. Dean Bark, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Cheyenne County is typical continental, as can be expected of a location in the interior of a large landmass in the middle latitudes. The climate is characterized by large daily and annual variations in temperature. Winters are cold because of frequent outbreaks of polar air. The cold temperatures prevail only from December to February. Warm summer temperatures prevail for about 6 months every year. They provide a long growing season for the crops grown in the county. Spring and fall are relatively short.

Cheyenne County is generally to the west of the flow of moisture-laden air from the Gulf of Mexico and is to the east of the strong rain-shadow effects of the Rocky Mountains. As a result, the annual amount of precipitation is marginal for cropping year after year.

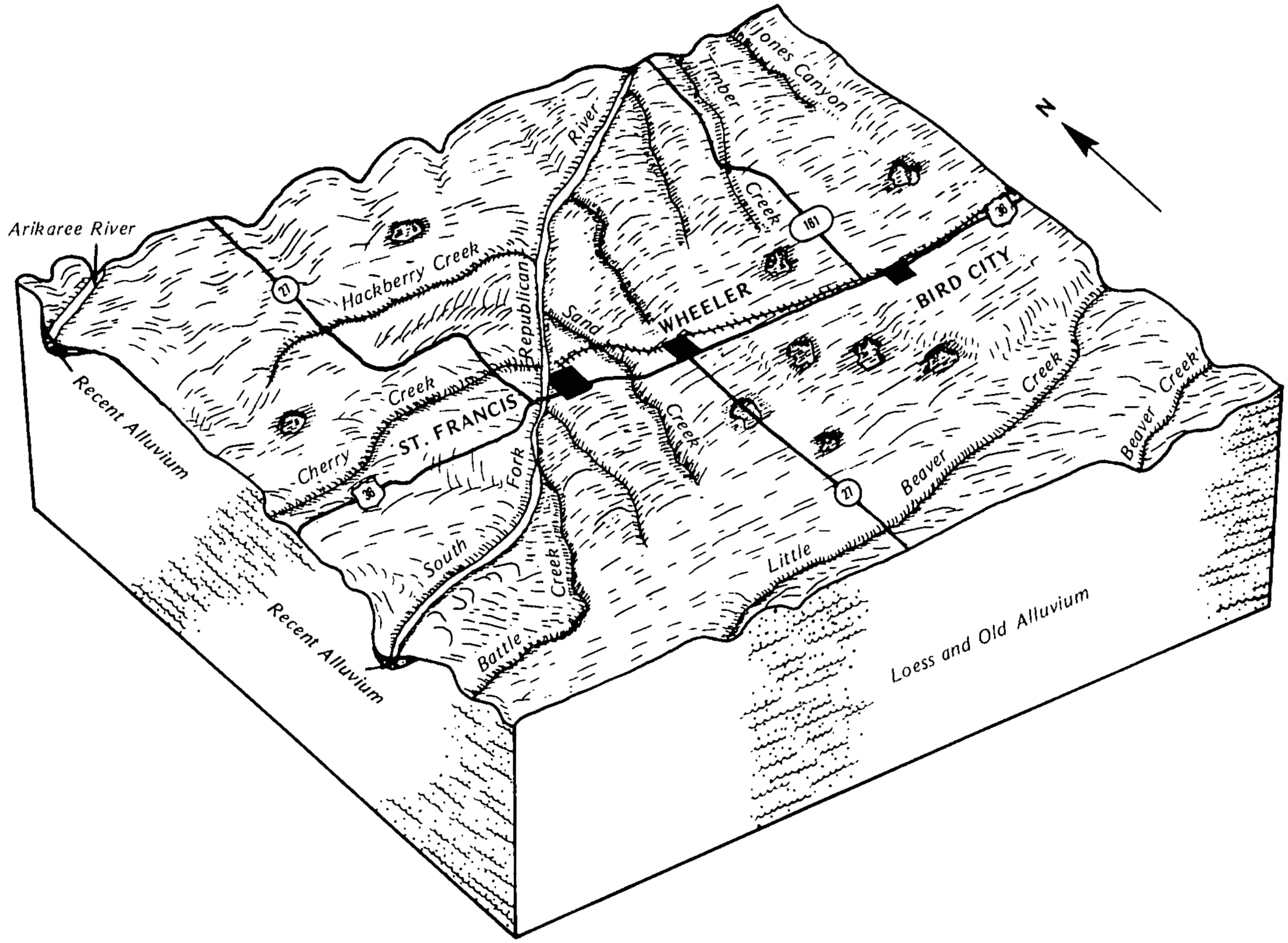

Figure 2.—General pattern of geology, relief, and drainage in Cheyenne County.

The precipitation generally falls during showers and thunderstorms that can be extremely heavy at times. Winds are relatively high and can cause significant soil loss and crop damage in the drier years.

Table 1 gives data on temperature and precipitation for the survey area as recorded at St. Francis in the period 1941 to 1970. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 32.6 degrees F, and the average daily minimum temperature is 18.4 degrees. The lowest temperature on record, which occurred at St. Francis on January 12, 1912, is -28 degrees. In summer the average temperature is 74.6 degrees, and the average daily maximum temperature is 89.0 degrees. The highest recorded temperature, which occurred on July 24, 1936, and July 24, 1940, is 111 degrees.

The total annual precipitation is 18.45 inches. Of this, 14.15 inches, or nearly 77 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 10.35 inches. The heaviest 1-day rainfall on record, which occurred at St. Francis on May 27, 1915, is 4.52 inches. Severe windstorms and occasional tornadoes accompany well developed thunderstorms. Although these storms are of local extent, they occur frequently enough to be a major hazard in the county.

The average seasonal snowfall is 35.3 inches. The highest recorded seasonal snowfall, which occurred during the winter of 1979-80, was 74.6 inches. On the

average, 35 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The sun shines 77 percent of the time possible in summer and 70 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in April.

Natural Resources

Soil is the most important natural resource in the county. It provides a growing medium for cash crops and for the grasses grazed by livestock. If managed and used properly, the soil is a renewable resource.

Water is available in sufficient quantity and quality for irrigation in many areas of the county. It is pumped from the Ogallala Formation and from wells along the major streams. Recharge of water in the Ogallala aquifer is minor, and the water level is declining in areas where use is heavy. Recharge in the alluvial and terrace deposits along the major streams is somewhat higher, but heavy pumping has reduced streamflow during periods of heavy use.

Other natural resources in the county include sand, gravel, and oil. An adequate supply of sand and gravel is available for use as road-building material and for other uses.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on

soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the lándscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are named and mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The descriptions and names of the soils identified on the general soil map of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

Soil Descriptions

1. Colby-Razor Association

Deep and moderately deep, moderately sloping to very steep, well drained soils that have a silty or clayey subsoil; on uplands

This association is on narrow ridgetops and on side slopes. It is dissected by entrenched drainageways. Slopes range from 3 to 50 percent.

This association makes up about 10 percent of the county. It is about 80 percent Colby soils, 8 percent Razor soils, and 12 percent minor soils (fig. 3).

The deep, moderately sloping to very steep Colby soils formed in loess on side slopes. Typically, the surface layer is grayish brown, calcareous silt loam about 5 inches thick. The next layer is light brownish gray, friable, calcareous silt loam about 6 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam.

The moderately deep, moderately sloping and strongly sloping Razor soils formed in material weathered from calcareous shale on side slopes. Typically, the surface layer is grayish brown, calcareous silty clay loam about 4 inches thick. The subsoil is about 22 inches thick. It is calcareous and very firm. The upper part is grayish brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is light yellowish brown, calcareous silty clay. Light brownish gray shale is at a depth of about 32 inches.

The minor soils in this association are the Bridgeport, Midway, Otero, and Ulysses soils. The well drained Bridgeport soils are on flood plains and stream terraces. The shallow Midway soils are on steep side slopes. The loamy Otero soils are on the lower side slopes. The silty Ulysses soils are on narrow divides and the upper side slopes.

Most of this association is used as range. Some small areas are used for cultivated crops. Wheat, grain sorghum, forage sorghum, corn, and alfalfa are the chief crops. Controlling water erosion, conserving moisture, and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of desirable grasses and forbs is the main concern in managing range.

2. Bridgeport-Bankard-Glenberg Association

Deep, nearly level to moderately sloping, well drained and somewhat excessively drained soils that have a silty or loamy subsoil or that are sandy throughout; on stream terraces and flood plains

This association is on broad stream terraces and flood plains that are dissected by river and stream channels. The Bankard soils and some areas of the Bridgeport soils are occasionally flooded. The Glenberg soils and some areas of the Bridgeport soils are subject

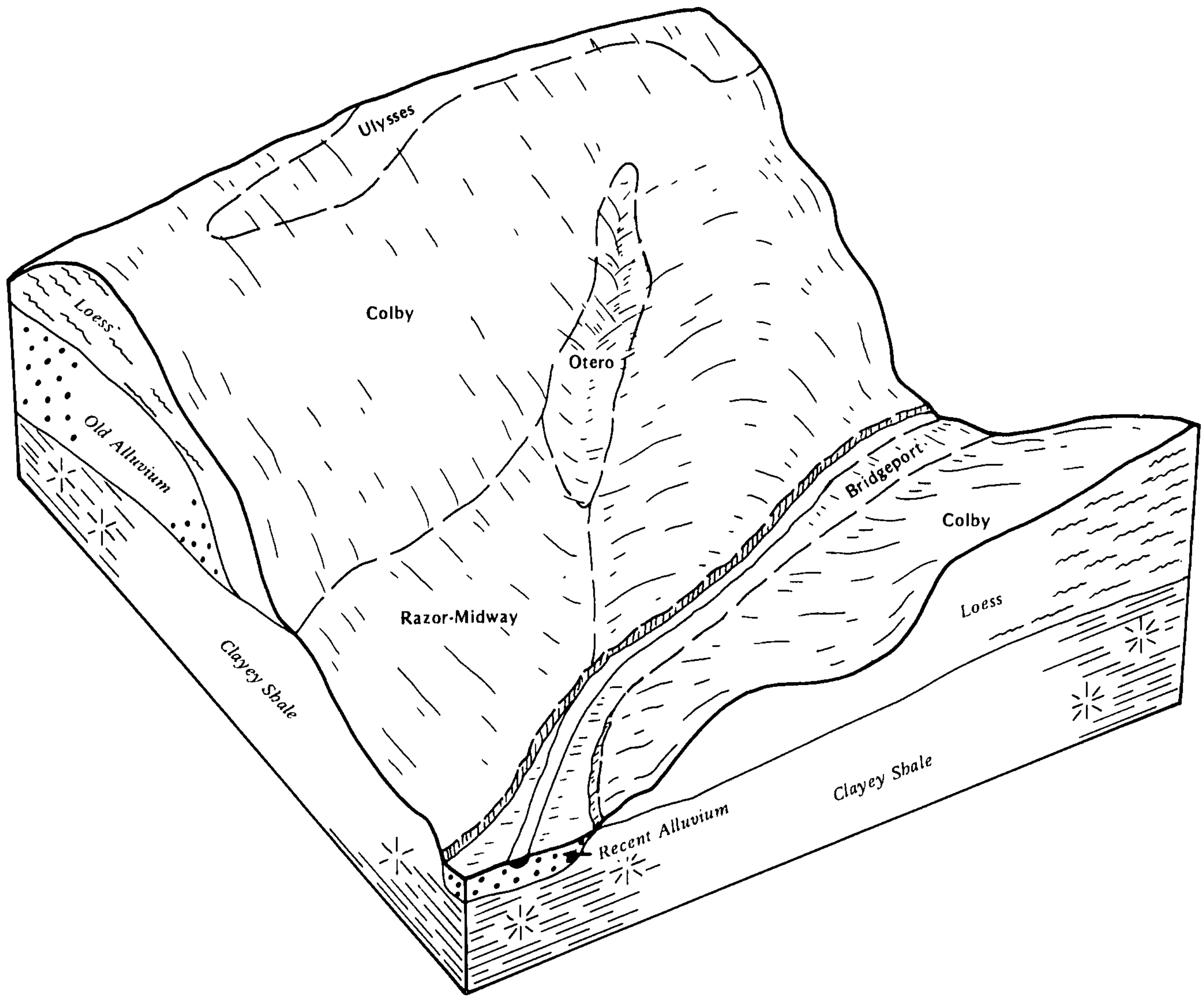

Figure 3.—Typical pattern of soils and parent material in the Colby-Razor association.

to rare flooding. Slopes range from 0 to 5 percent.

This association makes up about 5 percent of the county. It is about 40 percent Bridgeport soils, 30 percent Bankard soils, 20 percent Glenberg soils, and 10 percent minor soils.

The nearly level to moderately sloping, well drained Bridgeport soils formed in calcareous, silty alluvium on stream terraces and flood plains. Typically, the surface layer is grayish brown, calcareous silt loam about 12 inches thick. The subsurface layer is dark grayish brown, calcareous silt loam about 4 inches thick. The subsoil is friable, calcareous silt loam about 18 inches thick. The upper part is grayish brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The nearly level, somewhat excessively drained Bankard soils formed in sandy alluvium on flood plains. Typically, the surface layer is grayish brown, calcareous loamy fine sand about 6 inches thick. The upper part of the substratum is pale brown, calcareous loamy fine sand. The lower part to a depth of about 60 inches is very pale brown, calcareous fine sand.

The nearly level, well drained Glenberg soils formed in stratified, loamy alluvium on stream terraces.

Typically, the surface layer is grayish brown, calcareous fine sandy loam about 8 inches thick. The next layer is light brownish gray, friable, calcareous sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is calcareous sandy loam. The upper part is light brownish gray, and the lower part is pale brown.

The minor soils in this association are the Dwyer and Las Animas soils. The excessively drained Dwyer soils are on uplands. The loamy, calcareous, somewhat poorly drained Las Animas soils are on flood plains.

About half of this association is used for cultivated crops. The rest is used dominantly as range. Wooded strips are along the river and stream channels. Wheat, grain sorghum, forage sorghum, corn, and alfalfa are the chief crops. Some areas are irrigated by a flooding system and some by a sprinkler system. Controlling flooding and maintaining tilth and fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of desirable grasses and forbs is the main concern in managing range.

3. Colby-Ulysses-Keith Association

Deep, nearly level to moderately steep, well drained soils that have a silty subsoil; on uplands

This association is on ridgetops and side slopes that are dissected by entrenched drainageways. Slopes range from 0 to 20 percent.

This association makes up about 40 percent of the county. It is about 55 percent Colby soils, 30 percent Ulysses soils, 10 percent Keith soils, and 5 percent minor soils (fig. 4).

The moderately sloping to moderately steep Colby soils formed in loess on side slopes. Typically, the surface layer is grayish brown, calcareous silt loam about 5 inches thick. The next layer is light brownish gray, friable, calcareous silt loam about 6 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam.

The nearly level and gently sloping Ulysses soils formed in loess on ridgetops. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam.

The nearly level Keith soils formed in loess on ridgetops. Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam, and the lower part is light brownish gray, very friable, calcareous silt loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam.

The minor soils in this association are the Goshen and Kim soils. The well drained Goshen soils are in swales and narrow drainageways. The calcareous, loamy Kim soils are on side slopes.

Most of this association is used for cultivated crops. The steeper areas are used mainly as range. Wheat and grain sorghum are the chief dryland crops. Corn, grain sorghum, forage sorghum, alfalfa, and wheat are the chief irrigated crops. Controlling water erosion, maintaining tilth and fertility, and conserving moisture are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of desirable grasses is the main concern in managing range.

4. Manter-Satanta-Kim Association

Deep, nearly level to moderately sloping, well drained soils that have a loamy subsoil; on uplands

This association is on side slopes and narrow divides that are dissected by entrenched drainageways. The major soils formed in loamy old alluvium or loamy eolian material on the side slopes. Slopes range from 0 to 6 percent.

This association makes up about 10 percent of the county. It is about 40 percent Manter soils, 25 percent Satanta soils, 15 percent Kim soils, and 20 percent minor soils (fig. 5).

The moderately sloping Manter soils formed in loamy old alluvium or loamy eolian material on side slopes. Typically, the surface layer is grayish brown fine sandy loam about 10 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The subsoil is very friable sandy loam about 16 inches thick. The upper part is brown, and the lower part is pale brown and calcareous. The substratum to a depth of about 60 inches is pale brown, calcareous sandy loam.

The nearly level and gently sloping Satanta soils formed in loamy eolian material or loamy old alluvium on ridgetops and side slopes. Typically, the surface layer is grayish brown loam about 10 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is dark grayish brown, the next part is grayish brown, and the lower part is pale brown and calcareous. The substratum to a depth of about 60 inches is pale brown, calcareous loam.

The gently sloping and moderately sloping Kim soils formed in loamy old alluvium on side slopes. Typically,

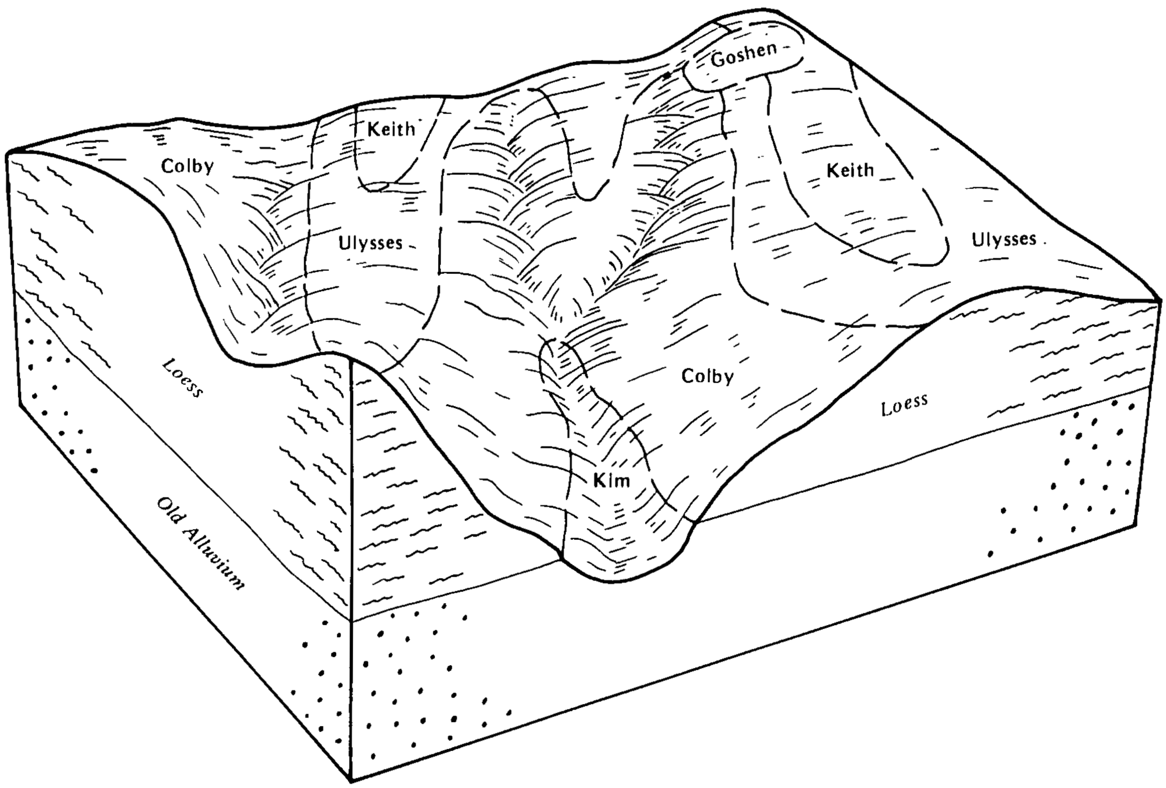

Figure 4.—Typical pattern of soils and parent material in the Colby-Ulysses-Keith association.

the surface layer is grayish brown, calcareous loam about 6 inches thick. The next layer is light brownish gray, friable, calcareous clay loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous clay loam.

The minor soils in this association are the Bankard, Canyon, Dwyer, Otero, and Ulysses soils. The sandy Bankard soils are on low flood plains. The excessively drained Dwyer soils are on dunelike uplands. The shallow Canyon soils are on steep side slopes. The loamy Otero soils are on the lower side slopes. The silty Ulysses soils are on ridgetops and side slopes.

About half of this association is used for cultivated crops. The rest is used as range. Most of the nearly level and gently sloping areas are cultivated. The steeper areas and the sandy areas are used mainly as range. Wheat and grain sorghum are the chief dryland crops. A few areas are irrigated by sprinklers. Corn, grain sorghum, alfalfa, and wheat are the chief irrigated crops. Controlling water erosion and soil blowing, maintaining tilth and fertility, and conserving moisture are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of desirable grasses and forbs is the main concern in managing range.

5. Kuma-Keith-Ulysses Association

Deep, nearly level and gently sloping, well drained soils that have a silty subsoil; on uplands

This association is on broad ridgetops that have a poorly defined drainage pattern because of undrained depressions and small basins. The major soils formed in loess on the ridgetops. Slopes range from 0 to 3 percent.

This association makes up about 30 percent of the county. It is about 60 percent Kuma soils, 20 percent Keith soils, 15 percent Ulysses soils, and 5 percent minor soils.

The nearly level Kuma soils formed in loess on wide ridgetops. Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is dark grayish brown, friable silt loam, the next part is grayish brown, firm silty clay loam, and the lower part is dark grayish

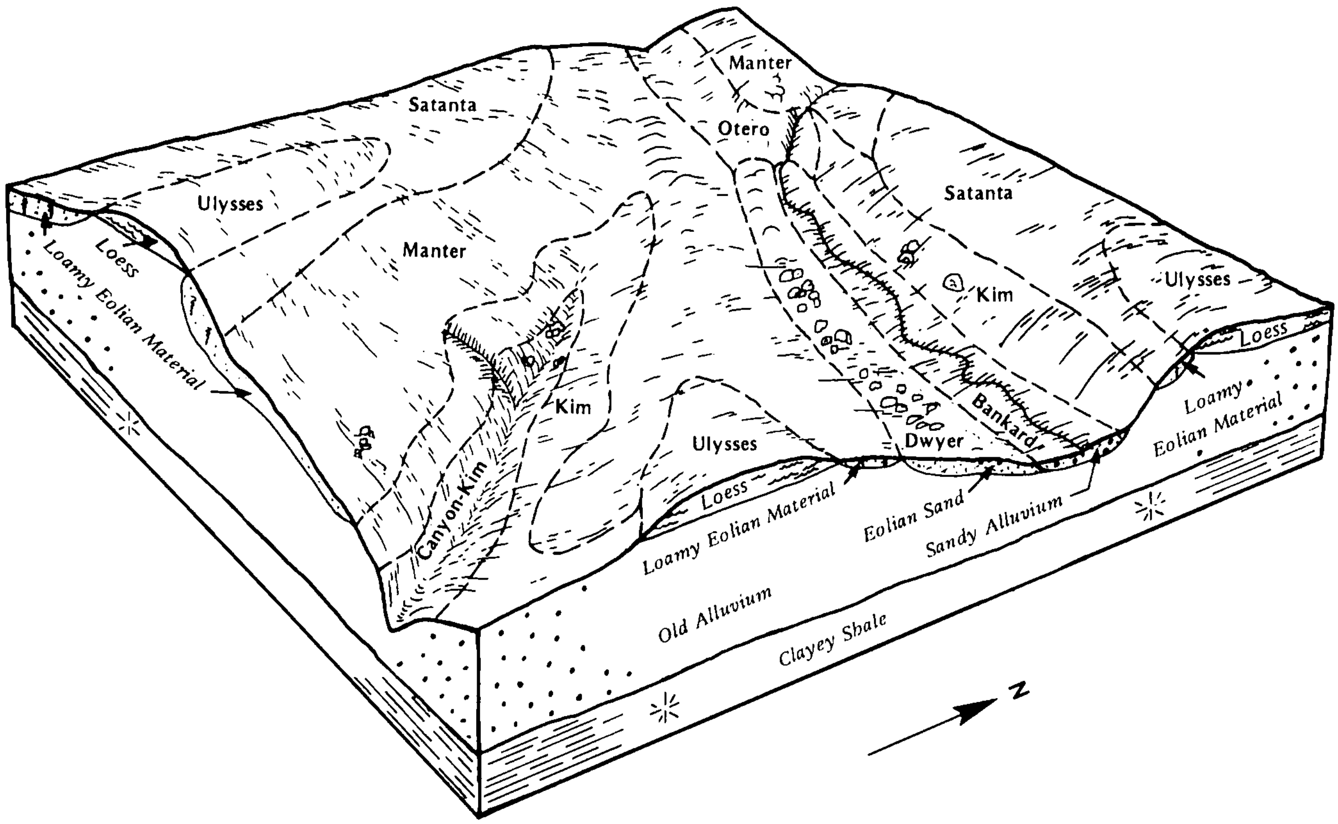

Figure 5.—Typical pattern of soils and parent material in the Manter-Satanta-Kim association.

brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

The nearly level Keith soils formed in loess on ridgetops. Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam, and the lower part is light brownish gray, very friable, calcareous silt loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam.

The nearly level and gently sloping Ulysses soils formed in loess on ridgetops. Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam.

The minor soils in this association are the Colby and Pleasant soils. The calcareous Colby soils are on the steeper side slopes and knolls. The moderately well drained Pleasant soils are in depressions.

Most of this association is used for cultivated crops. Winter wheat and grain sorghum are the chief dryland crops. Alfalfa, corn, grain sorghum, soybeans, and wheat are the chief irrigated crops. Controlling water erosion, conserving moisture, and maintaining tilth and fertility are the main management concerns.

6. Otero-Dwyer-Canyon Association

Deep and shallow, moderately sloping to steep, well drained to excessively drained soils that have a loamy subsoil or that are sandy throughout; on uplands

This association is on side slopes and narrow divides that are dissected by entrenched drainageways. Slopes range from 3 to 30 percent.

This association makes up about 5 percent of the

county. It is 55 percent Otero soils, 20 percent Dwyer soils, 15 percent Canyon soils, and 10 percent minor soils.

The deep, moderately sloping to moderately steep, well drained Otero soils formed in calcareous old alluvium on side slopes. Typically, the surface layer is grayish brown fine sandy loam about 8 inches thick. The next layer is light brownish gray, very friable sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous sandy loam.

The deep, moderately sloping to moderately steep, excessively drained Dwyer soils formed in sandy eolian material on rolling uplands. Typically, the surface layer is light brownish gray, calcareous loamy fine sand about 8 inches thick. The upper part of the substratum is pale brown, calcareous loamy fine sand. The lower part to a depth of about 60 inches is very pale brown, calcareous fine sand.

The shallow, moderately sloping to steep, somewhat excessively drained Canyon soils formed in calcareous, loamy material weathered from weakly cemented limestone or very fine grained sandstone. Typically, the surface layer is grayish brown, calcareous loam about 5 inches thick. The next layer is pale brown, friable, calcareous gravelly loam about 4 inches thick. The substratum is light gray, calcareous gravelly loam. White, weakly cemented, fine grained sandstone is at a depth of about 14 inches.

The minor soils in this association are the somewhat excessively drained Bankard and well drained Kim, Manter, and Satanta soils. The sandy, calcareous Bankard soils are on low flood plains. The calcareous Kim soils formed in old alluvium on narrow divides. Manter and Satanta soils have a dark surface layer. Manter soils formed in loamy old alluvium on side slopes. Satanta soils formed in loamy eolian material on narrow divides.

Most of this association is used as range. Some small areas are used for cultivated crops. Grain sorghum and wheat are the chief crops. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns in managing the cultivated areas. Maintaining the growth and vigor of desirable grasses and forbs is the main concern in managing range.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Bridgeport silt loam, 0 to 2 percent slopes, is a phase in the Bridgeport series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Kim-Razor complex, 3 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

The descriptions and names of the soils identified on the detailed soil maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties. Differences result from a better knowledge of soils, modifications in series concepts, a higher or lower intensity of mapping, and variations in the extent of the soils in the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Bc—Bankard loamy fine sand, occasionally flooded. This deep, nearly level, somewhat excessively drained soil is on flood plains. Individual areas are long and narrow and range from 20 to 100 acres in size.

Typically, the surface layer is grayish brown, calcareous loamy fine sand about 6 inches thick. The upper part of the substratum is pale brown, calcareous loamy fine sand. The lower part to a depth of about 60 inches is very pale brown, calcareous fine sand. In places the surface layer is loam or gravelly sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Caruso and Las Animas soils and small barren areas of gravelly sand. Caruso soils have less sand throughout than the Bankard soil, and Las Animas soils have less sand in the upper part. Included soils are on low flood plains along the river or stream channels. They make up about 10 percent of the map unit.

Permeability is rapid in the Bankard soil. Available water capacity is very low. Surface runoff is slow. Organic matter content and natural fertility are low.

Most areas are used as range. Because of the very low available water capacity and the hazards of flooding and soil blowing, this soil is generally unsuited to cultivated crops. It is better suited to range and woodland. The native vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, switchgrass, and woody species, such as cottonwood and willow. If the range is overgrazed, these plants are replaced by less productive plants, such as blue grama, sand dropseed, and sand sagebrush. Soil blowing is a hazard if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Well distributed salting and watering facilities and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is VIw, nonirrigated, and the range site is Sands.

Bg—Bridgeport silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is on low terraces near the larger streams. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to 500 acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 12 inches thick (fig. 6). The subsurface layer is dark grayish brown, calcareous silt loam about 4 inches thick. The subsoil is friable, calcareous silt loam about 18 inches thick. The upper part is grayish brown, and the lower part is pale brown. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In places the surface layer is sandy loam or is noncalcareous.

Included with this soil in mapping are small areas of the loamy Glenberg soils. These soils are in landscape positions similar to those of the Bridgeport soil. They make up about 5 percent of the map unit.

Permeability is moderate in the Bridgeport soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 70 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is well suited to dryland wheat and grain sorghum. Alfalfa is grown in some areas. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to irrigation. Corn, grain sorghum, and alfalfa are suitable irrigated crops. A sprinkler system is the chief method of irrigation. Efficient water management is needed. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility. Leaving crop residue on the surface increases the rate of water infiltration.

No major problems affect the use of this soil as range. The native vegetation is dominantly big bluestem, sideoats grama, little bluestem, and western wheatgrass. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and inland saltgrass. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate and a scheduled deferment of grazing during the growing season helps to keep the range productive.

The trees and shrubs that grow along the streams stabilize their banks, beautify the landscape, add vegetative diversity, attract woodland wildlife, and provide permanent food and cover during winter months.

This soil is poorly suited to dwellings because of the flooding. Dikes, levees, or other flood-control structures are needed. Onsite inspection and knowledge of an area's flooding history are needed when building sites are selected. The highest areas on the landscape should be selected as sites for buildings.

This soil is moderately well suited to septic tank absorption fields and sewage lagoons. The flooding is a hazard on sites for septic tank absorption fields. Levees reduce this hazard. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Loamy Terrace.

Bh—Bridgeport silt loam, 2 to 5 percent slopes. This deep, moderately sloping, well drained soil is on

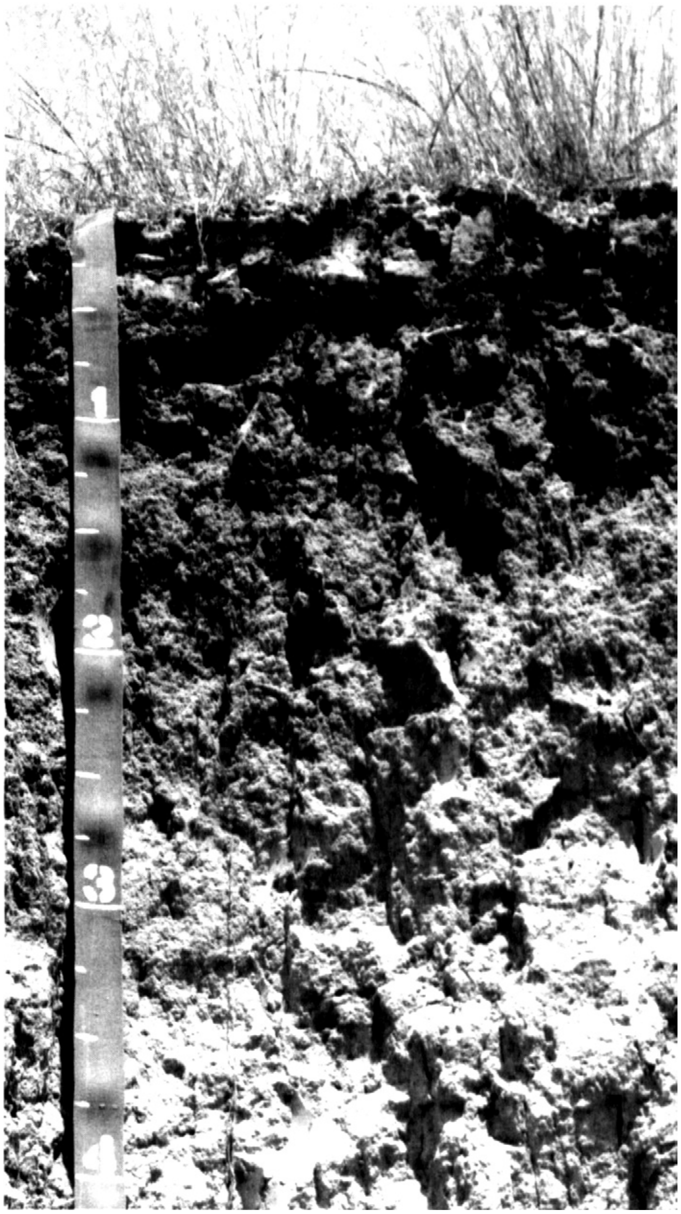

Figure 6.—Typical profile of Bridgeport silt loam, 0 to 2 percent slopes. This soil has a dark surface layer. Depth is marked in feet.

stream terraces. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 12 inches thick. The subsurface layer is dark grayish brown, calcareous silt loam about 4 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam.

Included with this soil in mapping are small areas of Colby, Kim, and Ulysses soils on uplands. Colby and Ulysses soils formed in calcareous, silty loess. Colby soils have a strongly calcareous surface layer. Ulysses soils have a noncalcareous surface layer and subsurface layer. Kim soils formed in old alluvium. They have a loamy surface layer. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Bridgeport soil, and surface runoff is medium. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 50 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is moderately well suited to dryland wheat and grain sorghum. Water erosion and inadequate rainfall are problems if cultivated crops are grown. Terraces, contour farming, and stubble mulching or another form of conservation tillage that leaves part of the crop residue on the surface help to prevent excessive soil loss. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. In some areas diversions are needed to protect the soil against runoff from the adjacent uplands. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is moderately well suited to irrigation. Corn, grain sorghum, and alfalfa are suitable irrigated crops. A sprinkler system is the chief method of irrigation. Efficient water management is needed. Leaving crop residue on the surface helps to control water erosion and increases the rate of water infiltration. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

The native vegetation in the areas of range is dominantly big bluestem, sideoats grama, little bluestem, and western wheatgrass (fig. 7). If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and inland saltgrass. Water erosion is a hazard if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dwellings and septic tank

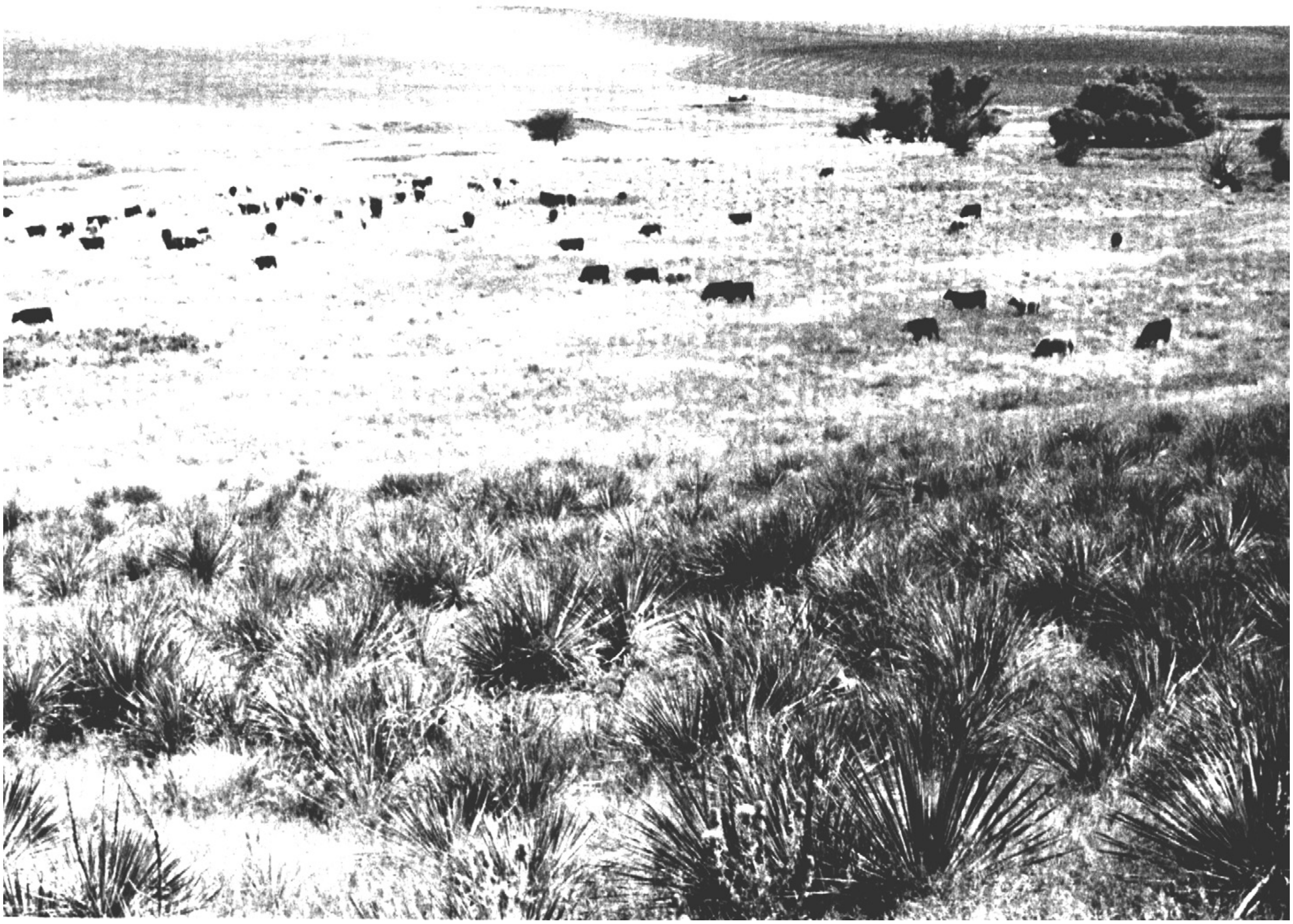

Figure 7.—Cattle grazing in an area of Bridgeport silt loam, 2 to 5 percent slopes. The yucca in the foreground is growing on strongly sloping Colby soils.

absorption fields. A diversion can protect the building site against runoff from the adjacent uplands. The soil is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping is commonly needed to overcome the slope.

The land capability classification is IIIe, nonirrigated and irrigated. The range site is Loamy Terrace.

Bs—Bridgeport silt loam, channeled. This deep, nearly level, well drained soil is on low flood plains. It is occasionally flooded. Individual areas are typically narrow and elongated. They are 100 to 500 feet wide, 600 to 1,000 feet long, and 10 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 12 inches thick. The subsurface layer is dark grayish brown, calcareous silt

loam about 4 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Caruso soils. These soils are in landscape positions similar to those of the Bridgeport soil. They make up about 5 percent of the map unit.

Permeability is moderate in the Bridgeport soil, and available water capacity is high. Surface runoff is slow. Natural fertility is high. Organic matter content is moderate.

Most areas are used as range. Because of the flooding and the difficulty in operating machinery along the meandering stream channels, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly big bluestem, western wheatgrass, switchgrass, and sideoats grama. If the range is overgrazed, these grasses are replaced by less desirable plants, such as sedges. Recurrent flooding, channeling, and deposition are hazards. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

The areas where range is adjacent to cropland or woodland provide good habitat for upland wildlife, such as quail, deer, rabbits, and numerous songbirds. Planting shrubs in the areas between cropland and range helps to provide winter cover.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is Vw, nonirrigated, and the range site is Loamy Lowland.

Bw—Bridgeport silt loam, occasionally flooded. This deep, nearly level, well drained soil is on flood plains along small creeks and intermittent drainageways. Individual areas are narrow and elongated. They are 200 to 300 feet wide, 600 feet to more than a mile long, and 10 to 100 acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 12 inches thick. The subsurface layer is dark grayish brown, calcareous silt loam about 4 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam. In places the surface layer is clay loam or loam.

Included with this soil in mapping are small areas of Bankard and Caruso soils. The sandy Bankard soils are slightly higher on the landscape than the Bridgeport soil. The somewhat poorly drained Caruso soils are on the lower flood plains near stream channels. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Bridgeport soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate.

Most areas are used as range. Some are used for cultivated crops. No major problems affect the use of this soil as range. The flooding can be a problem, however, in the spring. Also, grazing when the soil is too wet causes surface compaction. The native vegetation is dominantly big bluestem, sideoats grama, switchgrass, and western wheatgrass. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and inland saltgrass. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dryland alfalfa and grain sorghum. It is poorly suited to wheat, however, because of the hazard of flooding. Planting and harvesting are sometimes delayed by the flooding. Overcoming this hazard is difficult without major flood-control measures. Minimizing tillage and returning crop residue to the soil help to maintain tilth, fertility, and the organic matter content. In some areas diversion terraces are needed to control runoff from the adjacent uplands.

This soil is generally unsuited to building site development because of the flooding. Overcoming this hazard is difficult without major flood-control measures.

The land capability classification is IIw, nonirrigated, and the range site is Loamy Lowland.

Ca—Canyon-Kim loams, 5 to 30 percent slopes. These strongly sloping to steep soils are on the sides of deeply dissected drainageways in the uplands. The shallow, somewhat excessively drained Canyon soil is generally on the more sloping, lower side slopes. The deep, well drained Kim soil is on the less sloping, upper side slopes. Individual areas are irregular in shape and

range from 10 to several hundred acres in size. They are about 60 percent Canyon soil and 25 percent Kim soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is impractical.

Typically, the Canyon soil has a surface layer of grayish brown, calcareous loam about 5 inches thick. The next layer is pale brown, friable, calcareous gravelly loam about 4 inches thick. The substratum is light gray, calcareous gravelly loam. White, weakly cemented, fine grained sandstone is at a depth of about 14 inches. In places the substratum is gravelly sand below a depth of 40 inches. In some areas the surface layer is noncalcareous.

Typically, the Kim soil has a surface layer of grayish brown, calcareous loam about 6 inches thick. The next layer is light brownish gray, friable, calcareous clay loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous clay loam.

Included with these soils in mapping are small areas of Colby and Otero soils and small areas of caliche and gravelly outcrops on foot slopes. The deep, silty Colby soils are on the upper side slopes. The deep, loamy Otero soils are on the more sloping, lower side slopes. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the Canyon and Kim soils, and surface runoff is rapid. Available water capacity is high in the Kim soil and very low in the Canyon soil. Root development is restricted by the bedrock at a depth of 6 to 20 inches in the Canyon soil. Natural fertility is low in both soils, and organic matter content is very low. The surface layer is moderately alkaline.

Nearly all of the acreage is used as range. Because of the hazard of water erosion on both soils and the shallowness to hard sandstone in the Canyon soil, these soils are generally unsuited to cultivated crops. They are better suited to range. The native vegetation is dominantly big bluestem, little bluestem, blue grama, and sideoats grama, which is more extensive on the Canyon soil than on the Kim soil. If the range is overgrazed, these grasses are replaced by less productive plants, such as buffalograss, blue grama, small soapweed, and sand sagebrush. The grasses on these soils are commonly grazed less intensively than the grasses on the adjacent soils that are less sloping and thus are more accessible to livestock. Water erosion and soil blowing are hazards if the range is overused. Well distributed watering and salting facilities and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

Areas where range is adjacent to cropland provide good habitat for wildlife, including pheasant, quail, and cottontail rabbit.

The Kim soil is moderately well suited to dwellings and septic tank absorption fields and poorly suited to sewage lagoons. The slope is a limitation affecting all three uses. Sites for buildings and lagoons can be improved by land shaping. The lateral lines in septic tanks absorption fields should be installed on the contour. The moderate permeability restricts the absorption of effluent in these fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil.

The Canyon soil is generally unsuited to building site development because of the slope and the shallowness to bedrock.

The land capability classification is VIs, nonirrigated. The Canyon soil is in the Shallow Limy range site, and the Kim soil is in the Limy Upland range site.

Cf—Caruso silty clay loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains along some of the larger streams in the county. Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous silty clay loam about 10 inches thick. The subsurface layer is grayish brown, calcareous clay loam about 9 inches thick. The substratum to a depth of about 60 inches is mottled, calcareous loam. The upper part is brown, and the lower part is pale brown. In some places the surface layer is light brownish gray. In other places the substratum is not mottled.

Included with this soil in mapping are small areas of the well drained, silty Bridgeport soils on the slightly higher stream terraces and small areas of Las Animas soils on flood plains. Las Animas soils are more sandy than the Caruso soil. Also included are small areas of saline soils. Included soils make up about 5 percent of the map unit.

Permeability is moderate in the Caruso soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate. A seasonal high water table is at a depth of about 2 to 3 feet in the spring. The shrink-swell potential is moderate in the upper part of the soil and low in the lower part.

Most areas are used as range. Some are used for cultivated crops. No major problems affect the use of this soil as range. The flooding and wetness can be

problems, however, in the spring. Grazing when the soil is too wet causes surface compaction. The native vegetation is dominantly big bluestem, switchgrass, and prairie cordgrass. If the range is overgrazed, these grasses are replaced by less productive plants, such as western wheatgrass and annual grasses and forbs. Because of the availability of water, the vegetation remains lush and green throughout the growing season. Because the lush vegetation attracts grazing animals, special management techniques are needed to prevent overgrazing. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is moderately well suited to dryland alfalfa and grain sorghum. It is poorly suited to wheat, however, because of the flooding and the wetness. Planting and harvesting are sometimes delayed by the wetness. Overcoming the flooding hazard is difficult without major flood-control measures. Minimizing tillage and returning crop residue to the soil help to maintain tilth, fertility, and the organic matter content. In some areas diversion terraces are needed to control runoff from the adjacent uplands.

This soil is generally unsuited to building site development because of the wetness and the flooding. Overcoming the hazard of flooding is difficult without major flood-control measures.

The land capability classification is IIw, nonirrigated, and the range site is Subirrigated.

Co—Colby silt loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on side slopes and along drainageways in the uplands. Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 5 inches thick. The next layer is pale brown, friable, calcareous silt loam about 6 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In some places water erosion has exposed the very pale brown, strongly calcareous substratum. In other places the surface layer is darker and is noncalcareous.

Included with this soil in mapping are small areas of the loamy Kim and Otero soils on the steeper slopes. These soils make up about 15 percent of the map unit.

Permeability is moderate in the Colby soil, and surface runoff is medium. Available water capacity is high. Natural fertility is medium. Organic matter content is low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 60 percent of the acreage is used as range. The rest is used for cultivated crops. The native vegetation in the areas of range is dominantly little bluestem, sideoats grama, big bluestem, and blue grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, tall dropseed, and small soapweed. Water erosion is a hazard if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Well distributed salting and watering facilities and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is poorly suited to dryland wheat and grain sorghum. Grain sorghum is susceptible to chlorosis because of the high content of lime. Water erosion and inadequate rainfall are problems if cultivated crops are grown. Terraces, contour farming, and stubble mulching or other forms of conservation tillage that leave all or part of the crop residue on the surface help to prevent excessive soil loss. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. In some areas diversions are needed to protect the soil against runoff from the adjacent uplands. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

Areas where range is adjacent to cropland provide good habitat for several kinds of wildlife. Common species include pheasant and cottontail rabbit. The habitat can be improved by planting trees and shrubs or by leaving small areas of unharvested crops along the edge of the cropland.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping commonly is needed to overcome the slope.

The land capability classification is IVe, nonirrigated, and the range site is Limy Upland.

Cp—Colby silt loam, 6 to 20 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is on side slopes along drainageways in the

uplands. Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 5 inches thick. The next layer is light brownish gray, friable, calcareous silt loam about 6 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam. In some places water erosion has exposed the very pale brown substratum. In other places the surface layer is dark grayish brown.

Included with this soil in mapping are small areas of Bridgeport, Canyon, Kim, and Otero soils. The occasionally flooded Bridgeport soils are in the upland drainageways. Their surface layer is darker than that of the Colby soil. The shallow Canyon soils and the loamy Kim soils are on the lower side slopes. The well drained Otero soils are in positions on the landscape similar to those of the Colby soil. They are more sandy than the Colby soil. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Colby soil, and surface runoff is rapid. Available water capacity is high. Natural fertility is medium. Organic matter content is low.

Nearly all of the acreage is used as range. Because of the hazard of water erosion, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly little bluestem, sideoats grama, big bluestem, and blue grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, tall dropseed, and small soapweed. Water erosion is a hazard if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Well distributed salting and watering facilities (fig. 8) and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

Areas where range is adjacent to cropland provide good habitat for several kinds of wildlife. Common species include pheasant and cottontail rabbit. The habitat can be improved by planting trees and shrubs or by leaving small areas of unharvested crops along the edge of the cropland.

Because of the slope, this soil is only moderately well suited to dwellings and septic tank absorption fields and is generally unsuited to sewage lagoons. Some land shaping is commonly needed on building sites. The south-facing slopes may be ideal sites for dwellings that are partly underground. Land shaping and installing the distribution lines on the contour help to ensure that the absorption fields function properly. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is VIe, nonirrigated, and the range site is Limy Upland.

Cs—Colby silt loam, 20 to 50 percent slopes. This deep, moderately steep to very steep, well drained soil is on side slopes along drainageways in the uplands. Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous silt loam about 5 inches thick. The next layer is pale brown, friable, calcareous silt loam about 6 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In places water erosion has exposed the very pale brown substratum. In some areas the surface layer is dark grayish brown. In other areas it is loam.

Included with this soil in mapping are small areas of Bridgeport, Canyon, Kim, and Otero soils and small areas of steep breaks. The occasionally flooded Bridgeport soils are on flood plains. Their surface layer is darker than that of the Colby soil. The shallow Canyon soils and the loamy Kim soils are on the lower side slopes. The well drained, loamy Otero soils are in positions on the landscape similar to those of the Colby soil. The steep breaks are barren areas of clayey shale or loess. Included areas make up about 15 percent of the map unit.

Permeability is moderate in the Colby soil, and surface runoff is very rapid. Available water capacity is high. Natural fertility and organic matter content are low.

Nearly all of the acreage is used as range. Because of the hazard of water erosion, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly little bluestem, sideoats grama, western wheatgrass, and blue grama. Shrubs, such as sumac, plum, chokecherry, currant, and snowberry, grow on the steep breaks. If the range is overgrazed, the dominant native grasses are replaced by less productive plants, such as blue grama, buffalograss, tall dropseed, and small soapweed. Water erosion is a hazard if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Well distributed salting and watering facilities and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

Figure 8.—A windmill in an area of Colby silt loam, 6 to 20 percent slopes.

Areas where range is adjacent to cropland and areas on the steep breaks provide good habitat for several kinds of wildlife. Common species include pheasant and cottontail rabbit. The habitat can be improved by planting trees and shrubs or by leaving small areas of unharvested crops along the edge of the cropland.

This soil is poorly suited to dwellings. Because of the slope, some land shaping is commonly needed. The south-facing slopes may be ideal sites for dwellings that are partly underground.

Because of the slope, this soil is poorly suited to septic tank absorption fields and is generally unsuited to sewage lagoons. Land shaping and installing the distribution lines on the contour help to ensure that the absorption fields function properly. If the less sloping areas are selected as sites for lagoons, less leveling and banking will be needed during construction.

The land capability classification is VIIe, nonirrigated, and the range site is Loess Breaks.

Dw—Dwyer loamy fine sand, rolling. This deep, moderately sloping to moderately steep, excessively drained soil is on uplands. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is light brownish gray, calcareous loamy fine sand about 8 inches thick. The upper part of the substratum is pale brown, calcareous loamy fine sand. The lower part to a depth of about 60 inches is very pale brown, calcareous fine sand. In some places erosion has exposed the substratum. In

other places the surface layer has thin strata of fine sandy loam.

Included with this soil in mapping are small areas of the loamy Canyon, Manter, and Otero soils. The shallow Canyon soils are on side slopes. Manter and Otero soils are on the upper side slopes. Manter soils are noncalcareous. Included soils make up about 15 percent of the map unit.

Permeability is rapid in the Dwyer soil, and surface runoff is very slow. Available water capacity is very low. Natural fertility and organic matter content are low.

Most areas are used as range. Because of the very low available water capacity and the hazard of soil blowing, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly sand bluestem, little bluestem, western wheatgrass, and prairie sandreed. If the range is overgrazed, these grasses are replaced by less desirable plants, such as sand dropseed, sagebrush, and silver sagebrush. Soil blowing is a hazard if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dwellings, but it is generally unsuitable as a site for sanitary facilities because of the sandy substratum.

The land capability classification is VIe, nonirrigated, and the range site is Sands.

Gb—Glenberg fine sandy loam. This deep, nearly level, well drained soil is on stream terraces along the South Fork of the Republican River and along other major streams in the county. It is subject to rare flooding. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, calcareous fine sandy loam about 8 inches thick. The next layer is light brownish gray, friable, calcareous sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is calcareous sandy loam. The upper part is light brownish gray, and the lower part is pale brown.

Included with this soil in mapping are small areas of Bankard and Bridgeport soils. The somewhat excessively drained, sandy Bankard soils are lower on the flood plains than the Glenberg soil. The silty Bridgeport soils are in positions on the landscape similar to those of the Glenberg soil or are in lower areas. Included soils make up about 10 percent of the map unit.

Permeability is moderately rapid in the Glenberg soil, and surface runoff is slow. Available water capacity is moderate. Organic matter content is low. Natural fertility is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 50 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is moderately well suited to dryland wheat and grain sorghum. Alfalfa is grown in some areas. Inadequate rainfall and soil blowing are problems if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Wind stripcropping, a cropping sequence that includes grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

No major problems affect the use of this soil as range. Soil blowing is a hazard if the range is overused. The native vegetation is dominantly sand bluestem, prairie sandreed, and switchgrass. If the range is overgrazed, these grasses are replaced by less productive plants, such as sand dropseed, blue grama, and western wheatgrass. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

Because of the flooding, this soil is poorly suited to dwellings and sewage lagoons and is only moderately well suited to septic tank absorption fields. Dikes, levees, or other flood-control structures are needed. Onsite inspection and knowledge of an area's flooding history are needed when building sites are selected. The highest areas on the landscape should be selected as sites for buildings. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIIe, nonirrigated, and the range site is Sandy Terrace.

Gn—Goshen silt loam. This deep, nearly level, well drained soil is in small depressions or swales on uplands. It is subject to rare flooding by runoff from the adjacent uplands. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 11 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, friable silt loam; the next part is grayish brown, firm silty clay loam; and the lower part is light brownish gray, friable, calcareous silt loam. The substratum to a depth of about 60 inches is calcareous, pale brown silt loam. In a few places the surface layer is calcareous.

Included with this soil in mapping are small areas of the moderately well drained, clayey Pleasant soils in shallow depressions. These soils make up less than 1 percent of the map unit.

Permeability is moderate in the Goshen soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Nearly all of the acreage is used for cultivated crops. The rest is used as range. This soil is well suited to dryland wheat and grain sorghum. Alfalfa is grown in some areas. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

No major problems affect the use of this soil as range. The native vegetation is dominantly big bluestem, sideoats grama, western wheatgrass, and little bluestem. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and western wheatgrass. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is poorly suited to dwellings because of the flooding. Dikes, levees, or other flood-control structures are needed. Onsite inspection and knowledge of an area's flooding history are needed when building sites are selected. The highest areas on the landscape should be selected as sites for buildings.

This soil is moderately well suited to septic tank absorption fields and sewage lagoons. The flooding is a hazard on sites for septic tank absorption fields. Levees reduce this hazard. The moderate permeability restricts the absorption of effluent. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Loamy Terrace.

Ka—Keith silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on upland flats, mainly on the divides between drainageways. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 4 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam, and the lower part is light brownish gray, very friable, calcareous silt loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam. In places the surface layer is calcareous, is silty clay loam, or both.

Included with this soil in mapping are small areas of the moderately well drained, clayey Pleasant soils in shallow depressions. These soils make up less than 1 percent of the map unit.

Permeability is moderate in the Keith soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Nearly all of the acreage is used for cultivated crops. This soil is well suited to wheat and grain sorghum. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to irrigation. Alfalfa, wheat, corn, and grain sorghum are suitable irrigated crops. Efficient water management is needed. Land leveling or contour furrows reduce the runoff rate and improve water distribution in areas irrigated by a flooding system. Tailwater pits help to recover irrigation water. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and

fertility. Leaving crop residue on the surface increases the rate of water infiltration.

This soil is well suited to dwellings and septic tank absorption fields, but it is only moderately well suited to sewage lagoons because of seepage. Sealing the floor and walls of the lagoon helps to control seepage.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Loamy Upland.

Km—Kim loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on the upper side slopes and divides in the uplands. Individual areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The next layer is light brownish gray, friable, calcareous clay loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous clay loam. In places the surface layer is noncalcareous.

Included with this soil in mapping are small areas of Satanta and Ulysses soils. Satanta soils are on the upper side slopes. The silty Ulysses soils are on broad ridgetops. Both soils have a noncalcareous surface layer. They make up about 5 percent of the map unit.

Permeability is moderate in the Kim soil, and surface runoff is medium. Available water capacity is high. Natural fertility is medium. Organic matter content is low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 70 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is well suited to dryland wheat and grain sorghum. Inadequate rainfall, water erosion, and soil blowing are problems if cultivated crops are grown. Grain sorghum is susceptible to chlorosis because of a high content of lime in the soil. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Terraces, contour farming, wind stripcropping, a cropping sequence that includes grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

The native vegetation in the areas of range is dominantly big bluestem, sideoats grama, and little bluestem. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and inland saltgrass. Water erosion and soil blowing are hazards if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dwellings. It is moderately well suited to septic tank absorption fields and sewage lagoons. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage and slope are limitations on sites for sewage lagoons. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping is commonly needed to overcome the slope.

The land capability classification is IIe, nonirrigated, and the range site is Limy Upland.

Ko—Kim loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on the upper side slopes along drainageways in the uplands. Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 6 inches thick. The next layer is light brownish gray, friable, calcareous clay loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous clay loam. In places, all the surface soil has been removed and the strongly calcareous substratum is at the surface.

Included with this soil in mapping are small areas of Canyon, Colby, Otero, and Satanta soils. The silty Colby soils and the noncalcareous Satanta soils are on the upper side slopes. The shallow Canyon soils are on ridgetops. Otero soils are on the lower side slopes. They are more sandy than the Kim soil. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Kim soil, and surface runoff is medium. Available water capacity is high. Natural fertility is medium. Organic matter content is low. In most places the surface layer is calcareous. It is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 70 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is moderately well suited to dryland wheat and grain sorghum. Inadequate rainfall, water erosion, and soil blowing are problems if cultivated crops are grown. Grain sorghum is susceptible to chlorosis because of a high content of lime in the soil. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical

fallow. Stubble mulching is effective in trapping snow. Terraces, contour farming, wind stripcropping, a cropping sequence that includes grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

The native vegetation in the areas of range is dominantly little bluestem, sideoats grama, big bluestem, and blue grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and inland saltgrass. Water erosion and soil blowing are hazards if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dwellings. It is moderately well suited to septic tank absorption fields and sewage lagoons. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage and slope are limitations on sites for sewage lagoons. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping is commonly needed to overcome the slope.

The land capability classification is IIIe, nonirrigated, and the range site is Limy Upland.

Kr—Kim-Razor complex, 3 to 6 percent slopes. These moderately sloping, well drained soils are in the uplands. The deep Kim soil is on the upper side slopes. The moderately deep Razor soil is generally on the lower side slopes and on small knolls. Individual areas are irregular in shape and range from 10 to several hundred acres in size. They are about 60 percent Kim soil and 30 percent Razor soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Kim soil has a surface layer of grayish brown, calcareous loam about 6 inches thick. The next layer is light brownish gray, friable, calcareous clay loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown, calcareous clay loam.

Typically, the Razor soil has a surface layer of grayish brown, calcareous silty clay loam about 4 inches thick. The subsoil is about 22 inches thick. It is calcareous and very firm. The upper part is grayish brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is light yellowish brown, calcareous silty clay. Light brownish gray silty clay shale is at a depth of about 32 inches.

Included with these soils in mapping are small areas of Colby and Midway soils and gravelly outcrops. The deep, silty Colby soils are on the upper side slopes. The shallow, clayey Midway soils are on the lower side slopes. The gravelly outcrops are on foot slopes. Included areas make up about 10 percent of the map unit.

Permeability is moderate in the Kim soil and slow in the Razor soil. Surface runoff is medium on both soils. Available water capacity is high in the Kim soil and low in the Razor soil. Root development is restricted by the bedrock at a depth of 20 to 40 inches in the Razor soil. Natural fertility is medium in the Kim soil and low in the Razor soil. Organic matter content is low in both soils. The shrink-swell potential is high in the Razor soil and low in the Kim soil.

Most of the acreage is range. These soils are better suited to range than to cultivated crops. The native vegetation is dominantly little bluestem, sideoats grama, western wheatgrass, and blue grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, tall dropseed, and small soapweed. Water erosion and soil blowing are hazards if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Well distributed salting and watering facilities and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

About 25 percent of the acreage is used for cultivated crops. These soils are moderately well suited to dryland wheat and grain sorghum. Inadequate rainfall, water erosion, and soil blowing are hazards if cultivated crops are grown. Grain sorghum is susceptible to chlorosis because of a high content of lime in the soils. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Terraces, contour farming, wind stripcropping, cropping systems that include grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

The Kim soil is well suited to dwellings. It is moderately well suited to septic tank absorption fields and sewage lagoons. The moderate permeability restricts the absorption of effluent in septic tank

absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage and slope are limitations on sites for sewage lagoons. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping is commonly needed to overcome the slope.

The Razor soil is generally unsuited to building site development because of the high shrink-swell potential and the shallowness to bedrock.

The land capability classification is IVe, nonirrigated. The Kim soil is in the Limy Upland range site, and the Razor soil is in the Clay Upland range site.

Ku—Kuma silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on broad flats in the uplands. Individual areas are irregular in shape and range from 80 to about 1,000 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsoil is about 45 inches thick. The upper part is dark grayish brown, firm silt loam; the next part is grayish brown, firm silty clay loam; and the lower part is dark grayish brown, friable, calcareous silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam. In places the lower part of the subsoil is lighter in color.

Included with this soil in mapping are small areas of the moderately well drained, clayey Pleasant soils in shallow depressions. These soils make up less than 1 percent of the map unit.

Permeability is moderate in the Kuma soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Nearly all of the acreage is used for cultivated crops. The rest is used as range. This soil is well suited to dryland wheat and grain sorghum. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to irrigation. Corn, grain sorghum, wheat, and alfalfa are suitable irrigated crops (fig. 9). Efficient water management is needed. Land leveling or contour furrows reduce the runoff rate and improve water distribution in areas irrigated by a flooding system. Tailwater pits help to recover irrigation water. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility. Leaving crop residue on the surface increases the rate of water infiltration.

This soil is well suited to dwellings with basements. The moderate shrink-swell potential, however, is a limitation on sites for dwellings without basements. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material around the foundations help to prevent the structural damage caused by shrinking and swelling.

This soil is moderately well suited to septic tank absorption fields and sewage lagoons. The moderate permeability restricts the absorption of effluent in septic tank absorption fields. It can be overcome by enlarging the field or by installing the lateral lines below the subsoil. Seepage is a limitation on sites for sewage lagoons. It can be controlled by sealing the floor and walls of the lagoon.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Loamy Upland.

Lh—Las Animas loam, occasionally flooded. This deep, nearly level, somewhat poorly drained soil is on flood plains along the major streams. Individual areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is light brownish gray, calcareous loam about 6 inches thick. The next layer is pale brown, friable, calcareous fine sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is calcareous and mottled. The upper part is light gray clay loam, the next part is light brownish gray fine sandy loam, and the lower part is very pale brown fine sand.

Included with this soil in mapping are small areas of Bankard, Bridgeport, and Caruso soils. The somewhat excessively drained, sandy Bankard soils are on slightly undulating flood plains. The well drained, silty Bridgeport soils are on low terraces and on flood plains. Caruso soils contain less sand than the Las Animas soil. They generally are along streams that drain areas of silty soils in the uplands. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the upper part of the Las Animas soil and rapid in the lower part. Surface runoff is slow. Available water capacity is moderate. Natural fertility is medium. Organic matter content is low. A seasonal high water table is at a depth of about 1.5 to

Figure 9.—Harvesting corn in an irrigated area of Kuma silt loam, 0 to 1 percent slopes.

3.0 feet in winter and spring. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as range. This soil is better suited to range than to cultivated crops. No major problems affect the use of this soil as range. The flooding and the wetness can be problems, however, in the spring. Grazing when the soil is too wet causes surface compaction. The native vegetation is dominantly sand bluestem, switchgrass, and indiangrass. If the range is overgrazed, these grasses are replaced by less productive plants, such as western wheatgrass, saltgrass, and sedges. Because of the availability of water, the vegetation remains lush and green throughout the growing season. Because the lush vegetation attracts grazing animals, special management techniques are needed to prevent overgrazing. Areas near watering facilities and shade trees where animals congregate are generally overused and in poor condition. Fencing and properly locating salting and watering facilities can help to distribute grazing evenly. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

About 25 percent of the acreage is used for cultivated crops. This soil is moderately well suited to dryland alfalfa and grain sorghum. It is poorly suited to dryland wheat because of the flooding and the wetness. Planting and harvesting are sometimes delayed by the

wetness. Overcoming the hazard of flooding is difficult without major flood-control measures. Minimizing tillage and returning crop residue to the soil help to maintain tilth, fertility, and the organic matter content.

The vegetation commonly growing on this soil provides habitat for many kinds of wildlife, including deer, wild turkey, and pheasants. The habitat can be improved by increasing the number of fringe areas where woodland is adjacent to cropland.

This soil is generally unsuited to building site development because of the flooding and the wetness. Overcoming the hazard of overflow is difficult without major flood-control measures.

The land capability classification is IIIw, nonirrigated, and the range site is Subirrigated.

Mc—Manter fine sandy loam, 2 to 5 percent slopes. This deep, moderately sloping, well drained soil is on mounds and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 10 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The subsoil is very friable sandy loam about 16 inches thick. The upper part is brown, and the lower part is pale brown and calcareous. The substratum to a depth of about 60 inches is pale brown, calcareous sandy loam. In some places the surface layer is calcareous. In other places the substratum is silt loam or sandy clay loam.

Included with this soil in mapping are small areas of Otero and Satanta soils. The calcareous Otero soils generally are on mounds above the Manter soil. Satanta soils are on the less sloping, lower side slopes. They contain less sand than the Manter soil. Included soils make up about 15 percent of the map unit.

Permeability is moderately rapid in the Manter soil, and surface runoff is medium. Available water capacity and organic matter content are moderate. Natural fertility is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

About 50 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is moderately well suited to dryland wheat and grain sorghum. Alfalfa is grown in some areas. Inadequate rainfall, water erosion, and soil blowing are problems if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Terraces, contour farming, wind stripcropping, a cropping sequence that includes grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

The native vegetation in the areas of range is dominantly sideoats grama, little bluestem, switchgrass, and blue grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as sand dropseed, sand sagebrush, and small soapweed. Water erosion and soil blowing are hazards if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dwellings and septic tank absorption fields. It is poorly suited to sewage lagoons, however, because of seepage. Sealing the floor and walls of the lagoon helps to control seepage.

The land capability classification is IIIe, nonirrigated, and the range site is Sandy.

Ot—Otero fine sandy loam, 5 to 15 percent slopes. This deep, strongly sloping and moderately steep, well drained soil is on mounds and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous fine sandy loam about 8 inches thick. The next layer is light brownish gray, very friable, calcareous sandy loam about 8 inches thick. The substratum to a depth of about 60 inches is very pale brown, calcareous sandy loam. In places it is silt loam or loam.

Included with this soil in mapping are small areas of Manter and Satanta soils. Both of these soils are noncalcareous in the upper part and have a dark surface layer. Manter soils are on the less sloping ridgetops. Satanta soils are on divides and the upper side slopes. They are more clayey than the Otero soil. Included soils make up about 10 percent of the map unit.

Permeability is moderately rapid in the Otero soil, and surface runoff is rapid. Available water capacity is moderate. Organic matter content is low. Natural fertility is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas are used as range. Because of the hazards of soil blowing and water erosion, this soil is generally unsuited to cultivated crops. It is better suited to range. The native vegetation is dominantly sideoats

grama, blue grama, little bluestem, sand dropseed, and switchgrass. If the range is overgrazed, these grasses are replaced by less desirable grasses, such as sand dropseed, sagebrush, and small soapweed. Soil blowing and water erosion are hazards if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

Because of slope and seepage, this soil is generally unsuitable as a site for sewage lagoons. It is only moderately well suited to dwellings and septic tank absorption fields because of the slope. Building sites can be improved by land shaping. The lateral lines in septic tank absorption fields should be installed on the contour.

The land capability classification is VIe, nonirrigated, and the range site is Sandy.

Ps—Pleasant silty clay loam. This deep, nearly level, moderately well drained soil is in depressions on uplands. It is frequently ponded. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 4 inches thick. The subsurface layer also is grayish brown silty clay loam about 4 inches thick. The subsoil is about 42 inches thick. In sequence downward, it is gray, very firm silty clay loam; gray, extremely firm silty clay; gray, firm silty clay loam; and light gray, friable silt loam. The substratum to a depth of about 60 inches is very pale brown, calcareous silt loam.

Permeability is very slow, and surface runoff is ponded. A seasonal high water table is at or above the surface from spring to fall. Available water capacity and organic matter content are moderate. Natural fertility is high. The surface layer is firm and cannot be easily tilled when dry or wet. The shrink-swell potential is high in the subsoil.

Nearly all areas are cultivated along with the surrounding areas. Wheat and sorghum are the chief crops. Because of the ponding, this soil is poorly suited to cultivated crops. Stubble mulching, terraces, and contour farming on the surrounding soils help to control the ponding on this soil. Soil blowing is a hazard during dry periods. It can be controlled by minimum tillage and stubble mulching.

The ponding on this soil results in shallow water areas that can be used as habitat by waterfowl and other kinds of wildlife. The cultivated fields in the adjacent areas provide food and nesting areas.

This soil is generally unsuited to building site development because of the ponding.

The land capability classification is IVw, nonirrigated, and the range site is Clay Upland.

Rm—Razor-Midway silty clay loams, 5 to 20 percent slopes. These strongly sloping and moderately steep, well drained soils are on the sides of deeply dissected drainageways in the uplands. The moderately deep Razor soil is on the upper side slopes. The shallow Midway soil is generally on knobs and the lower side slopes. Individual areas are irregular in shape and range from 10 to several hundred acres in size. They are about 50 percent Razor soil and 30 percent Midway soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Razor soil has a surface layer of grayish brown, calcareous silty clay loam about 4 inches thick. The subsoil is about 22 inches thick. It is calcareous and very firm. The upper part is grayish brown silty clay loam, and the lower part is light yellowish brown silty clay. The substratum is light yellowish brown, calcareous silty clay. Light brownish gray silty clay shale is at a depth of about 32 inches.

Typically, the Midway soil has a surface layer of light brownish gray, calcareous silty clay loam about 4 inches thick. The substratum is light yellowish brown, calcareous clay. Pale yellow, calcareous, clayey shale is at a depth of about 12 inches.

Included with these soils in mapping are small areas of the deep Bridgeport and Kim soils. The silty Bridgeport soils are on flood plains along upland drainageways. The loamy Kim soils are on the upper side slopes. Included soils make up about 20 percent of the map unit.

Permeability is slow in the Razor and Midway soils, and surface runoff is rapid. Available water capacity is very low in the Midway soil and low in the Razor soil. Natural fertility and organic matter content are low in both soils. Root development is restricted by the bedrock at a depth of 10 to 20 inches in the Midway soil and 20 to 40 inches in the Razor soil. The shrink-swell potential is high in the subsoil of both soils.

Most areas are used as range (fig. 10). Because of the hazard of water erosion on both soils and the shallowness to shale in the Midway soil, these soils are generally unsuited to cultivated crops. They are better suited to range. The native vegetation is dominantly blue grama, western wheatgrass, green needlegrass, and sideoats grama. If the range is overgrazed, these grasses are replaced by less productive plants, such as buffalograss, blue grama, small soapweed, and sand

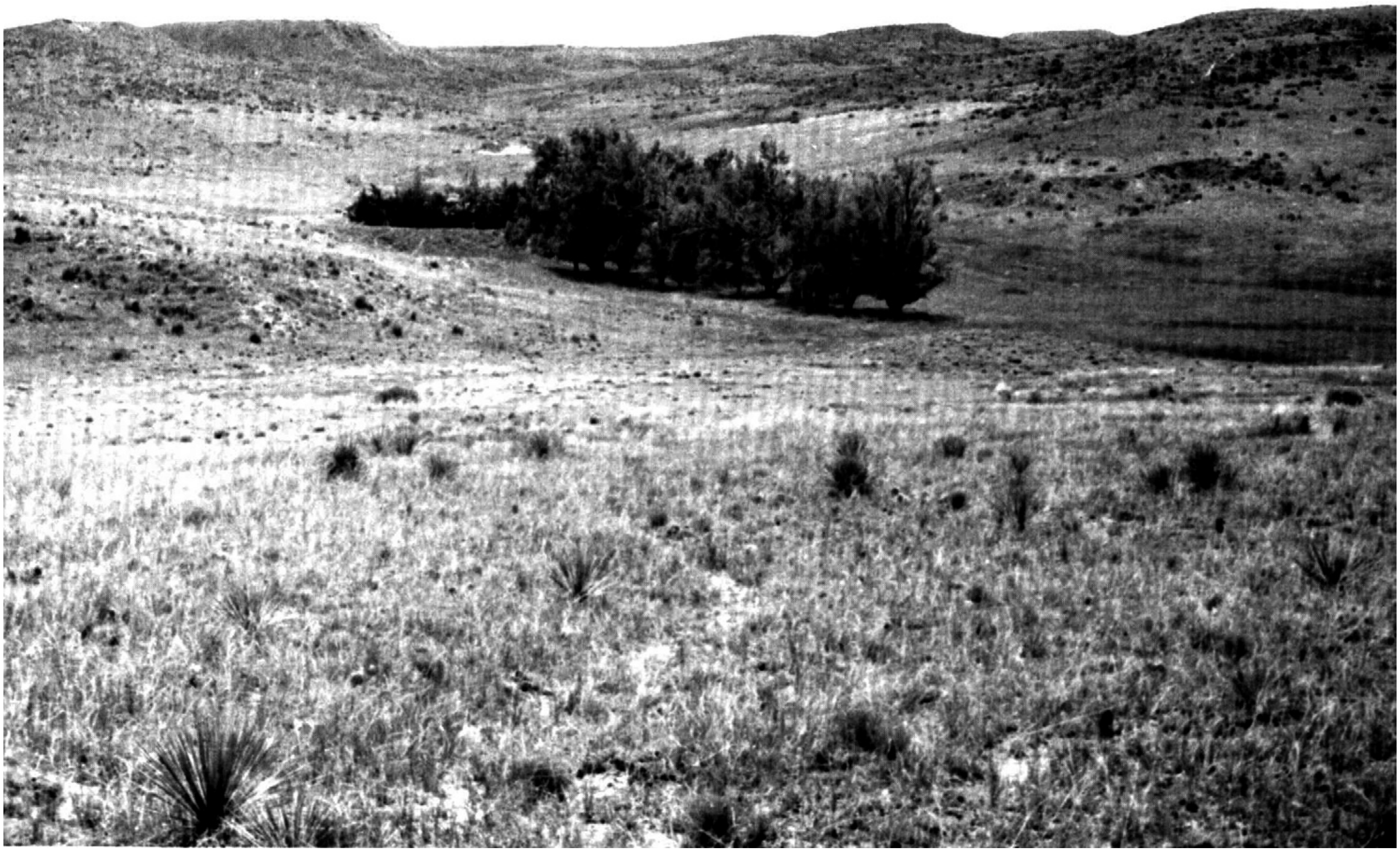

Figure 10.—An area of Razor-Midway silty clay loams, 5 to 20 percent slopes, used as range.

sagebrush. The grass on these soils is commonly grazed less intensively than the grass on adjacent soils that are less sloping and thus are more accessible to livestock. Water erosion is a hazard if the range is overused. Well distributed salting and watering facilities and properly located fences improve the distribution of grazing. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

Areas where range is adjacent to cropland provide good habitat for wildlife, including pheasant, quail, and cottontail rabbit.

These soils generally are unsuited to building site development because of the slope, the high shrink-swell potential, and the depth to bedrock.

The land capability classification is VIe, nonirrigated. The Razor soil is in the Clay Upland range site, and the Midway soil is in the Shale Breaks range site.

Sb—Satanta loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on the tops of ridges in the uplands. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown loam about 10 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is dark grayish brown, the next part is grayish brown, and the lower

part is pale brown and calcareous. The substratum to a depth of about 60 inches is pale brown, calcareous loam. In some places the subsoil is silty clay loam. In other places the surface layer is fine sandy loam or silt loam.

Included with this soil in mapping are small areas of Kim, Manter, and Pleasant soils. The calcareous Kim soils are on the lower side slopes. Manter soils are on mounds above the Satanta soil. They are more sandy than the Satanta soil. The moderately well drained, clayey Pleasant soils are in shallow depressions. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Satanta soil, and surface runoff is slow. Available water capacity is high. Organic matter content is moderately low. Natural fertility is high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Almost all areas are used for cultivated crops. The rest are used as range. This soil is well suited to dryland wheat and grain sorghum. Alfalfa is grown in some areas. Inadequate rainfall and soil blowing are problems if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Wind stripcropping, a cropping sequence that includes grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage. Sealing the floor and walls of the lagoon helps to control seepage.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Loamy Upland.

Sc—Satanta loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown loam about 10 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is grayish brown, and the lower part is pale brown and calcareous. The substratum to a depth of about 60 inches is pale brown, calcareous loam. In places the subsoil is silty clay loam.

Included with this soil in mapping are small areas of Manter and Ulysses soils. Manter soils are on mounds and side slopes above the Satanta soil. They are more sandy than the Satanta soil. The silty Ulysses soils are on ridgetops and the upper side slopes. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Satanta soil, and surface runoff is medium. Available water capacity and natural fertility are high. Organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Almost all areas are used for cultivated crops. This soil is moderately well suited to dryland wheat and grain sorghum. Inadequate rainfall, water erosion, and soil blowing are problems if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Terraces, contour farming, wind stripcropping, a cropping sequence that includes grasses and legumes, and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to dwellings and septic tank absorption fields. It is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping is commonly needed to overcome the slope.

The land capability classification is IIe, irrigated and nonirrigated, and the range site is Loamy Upland.

Ua—Ulysses silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on broad flats on summits in the uplands. Individual areas are irregular in shape and range from 60 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 6 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam. In some places the surface layer is calcareous. In other places the depth to calcareous material is more than 15 inches.

Included with this soil in mapping are small areas of the loamy Satanta soils. These soils are deeper to lime

Figure 11.—Planting wheat on the contour in an area of Ulysses silt loam, 1 to 3 percent slopes.

than the Ulysses soil. They are in landscape positions similar to those of the Ulysses soil. They make up about 5 percent of the map unit.

Permeability is moderate in the Ulysses soil, and surface runoff is slow. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Nearly all of the acreage is used for cultivated crops. This soil is well suited to dryland wheat and grain sorghum. Inadequate rainfall is a problem if cultivated crops are grown. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to irrigation. Alfalfa, wheat, corn, and grain sorghum are suitable irrigated crops. The soil is irrigated by gravity flow or by sprinklers. Efficient water management is needed. Land leveling or contour furrows reduce the runoff rate and improve water distribution in areas irrigated by a flooding system. Tailwater pits help to recover irrigation water. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility. Leaving crop residue on the surface increases the rate of water infiltration.

This soil is well suited to dwellings with basements.

The shrink-swell potential is a limitation, however, on sites for dwellings without basements. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material around the foundations help to prevent the structural damage caused by shrinking and swelling.

This soil is well suited to septic tank absorption fields, but it is only moderately well suited to sewage lagoons because of seepage. Sealing the floor and walls of the lagoon helps to control seepage.

The land capability classification is IIc, nonirrigated, and I, irrigated. The range site is Loamy Upland.

Ub—Ulysses silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is on convex ridgetops and the upper side slopes along drainageways in the uplands. Individual areas are long and wide and range from 40 to several hundred acres in size.

Typically, the surface layer is grayish brown silt loam about 5 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is grayish brown, friable, calcareous silt loam about 10 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous silt loam. In places the surface layer is calcareous.

Included with this soil in mapping are small areas of the loamy Manter and Satanta soils. Both of these soils are deeper to carbonates than the Ulysses soil. Manter soils are on mounds and side slopes. Satanta soils are on side slopes. Included soils make up about 5 percent of the map unit.

Permeability is moderate in the Ulysses soil, and surface runoff is medium. Available water capacity and natural fertility are high. Organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

About 50 percent of the acreage is used for cultivated crops. The rest is used as range. This soil is well suited to dryland wheat and grain sorghum. Inadequate rainfall and water erosion are problems if cultivated crops are grown. Grain sorghum is susceptible to chlorosis because of a high content of lime in the soil. Summer fallowing conserves moisture. It is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulching is effective in trapping snow. Terraces, contour farming (fig. 11), and conservation tillage help to prevent excessive soil loss. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility.

This soil is well suited to irrigation. Corn, grain sorghum, and alfalfa are suitable irrigated crops. Some wheat also is grown. Efficient water management is needed. Land leveling or contour furrows reduce the runoff rate and improve water distribution in areas irrigated by a flooding system. Tailwater pits help to recover irrigation water. Minimizing tillage and returning crop residue to the soil help to maintain the organic matter content, tilth, and fertility. Leaving crop residue on the surface helps to control water erosion and soil blowing and increases the rate of water infiltration.

The native vegetation in the areas of range is dominantly blue grama, sideoats grama, and western wheatgrass. If the range is overgrazed, these grasses are replaced by less productive plants, such as blue grama, buffalograss, and inland saltgrass. Water erosion and soil blowing are hazards if the range is overused. An adequate plant cover helps to prevent excessive soil loss. Grazing management that includes a proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season helps to keep the range productive.

This soil is well suited to dwellings with basements. The shrink-swell potential is a limitation, however, on sites for dwellings without basements. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with suitable coarse textured material around the foundations help to prevent the structural damage caused by shrinking and swelling.

This soil is well suited to septic tank absorption fields, but it is only moderately well suited to sewage lagoons because of seepage and slope. Seepage can be controlled by sealing the floor and walls of the lagoon. Some land shaping is commonly needed to overcome the slope.

The land capability classification is IIe, nonirrigated and irrigated. The range site is Loamy Upland.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department

of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 309,000 acres in the survey area, or more than 47 percent of the total acreage, meets the soil requirements for prime farmland where irrigated. Areas of this land are throughout the county, but most are in the Colby-Ulysses-Keith and Kuma-Keith-Ulysses associations, which are described under the heading "General Soil Map Units." About 40,000 acres of the prime farmland is irrigated cropland. The crops grown on this land are mainly corn, grain sorghum, and soybeans.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

As is indicated after the map unit names in table 5, the soils in the survey area qualify for prime farmland only in areas where inadequate rainfall has been overcome by irrigation. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to a capability classification and a range site at the end of each map unit description and in tables 6 and 7. The capability classification and range site for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops

Jerry B. Lee, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the chief crops and hay are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 380,000 acres in Cheyenne County, or nearly 60 percent of the total acreage, is used for cultivated crops or is summer fallowed *(6)*. During the period 1973 to 1983, wheat was grown on about 45 percent of the cropland, grain sorghum on 7 percent, and corn, alfalfa, soybeans, sugar beets, pinto beans, and sunflowers on 8 percent *(3)*. About 40 percent of the cropland was summer fallowed. About 13 percent currently is irrigated.

Crop production can be increased on most farms by applying the latest technology. This soil survey can facilitate the application of such technology. The main concerns in managing the soils in Cheyenne County for cultivated crops are controlling water erosion and soil blowing, making the most efficient use of the available water, and maintaining fertility and tilth.

Water erosion is the major hazard on about 50 percent of the cropland. It occurs mainly on soils that have a slope of more than 1 or 2 percent. Examples are Bridgeport, Colby, Kim, and Ulysses soils. Unless the surface is protected by a crop or crop residue, soil

blowing is a hazard on some of the soils that have a surface layer of fine sandy loam, loam, or loamy fine sand. Examples are Bankard, Glenberg, Las Animas, Manter, and Otero soils.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Secondly, erosion pollutes streams with sediments, nutrients, and pesticides. Control of erosion minimizes this pollution and improves the quality of water.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods in combination with a conservation tillage system that keeps crop residue on the surface helps to control erosion and preserves the productive capacity of the soils.

Conservation tillage and a conservation cropping system help to control water erosion and soil blowing. A system of conservation tillage leaves all or part of the crop residue on the surface. Examples are stubble mulching and chemical fallow. When these systems are applied, the stubble of crops or crop residue is left essentially in place to provide a protective cover before and during the preparation of a seedbed and at least a partial cover for the succeeding crop. Drilled crops, such as small grain, are alternated with row crops in a conservation cropping system. Wind stripcropping, or the production of crops in relatively narrow strips perpendicular to the direction of the prevailing wind, also is used in conservation cropping systems to help control soil blowing.

Terraces, diversions, grassed waterways, and contour farming are needed in combination with conservation tillage on soils that have a slope of more than 2 percent. Unless a system of conservation tillage is applied, they also are needed on soils that have a slope of more than 1 percent. Terraces and diversions help to control water erosion by shortening the length of slopes and thus reducing the runoff rate. Terraces also help to control erosion by intercepting concentrated runoff and conveying it to protected outlets. They are most practical on deep, well drained soils that have uniform slopes. Contour farming should generally be used in combination with terraces. It is best suited to those soils that have smooth, uniform slopes and are suitable for terracing.

Inadequate rainfall usually is a problem on all of the cropland in the county. As a result, the supply of water stored in the soil should be conserved or increased by summer fallowing and terracing. Summer fallowing allows the soil to store moisture during the summer for the growth of succeeding crops. Most of the fallowed cropland in the county is in a wheat-sorghum-fallow or wheat-fallow-wheat rotation. Summer fallowing is most effective when the crop residue is managed by stubble mulching or by chemical fallow. Stubble mulch is effective in trapping snow and thus in increasing the moisture supply. Both stubble mulching and terracing reduce the runoff rate.

Organic matter is a storehouse of available plant nutrients. It increases the rate of water intake, helps to prevent surface crusting, helps to control erosion, and improves tilth. Most of the soils in the county that are used for crops have a surface layer of silt loam. A surface crust forms during periods of intensive rainfall. When dry, the crusted surface is nearly impervious to water. As a result, the runoff rate is increased. Regularly adding organic material and leaving crop residue on the surface help to prevent excessive surface crusting, increase the rate of water infiltration, and reduce the runoff rate and the hazard of erosion.

Plants on most of the arable soils in the county respond well to applications of nitrate and phosphate fertilizer. On all soils the amount of fertilizer needed should be based on the results of soil tests, on the needs of the crop, on the expected level of yields, and on the experience of farmers. The Cooperative Extension Service can help to determine the kind and amount of fertilizer needed.

Information about the design of erosion-control practices is available in the local office of the Soil Conservation Service. The latest information about growing crops can be obtained from the Cooperative Extension Service or the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper

planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils cannot include major and generally expensive landforming that would change slope, depth, or characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretation designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and in the section "Interpretive Groups."

Rangeland

Loren J. Pearson, range conservationist, Soil Conservation Service, helped prepare this section.

About 220,000 acres in Cheyenne County, or nearly 34 percent of the total acreage, is range *(6)*. The range is throughout the county, but it is generally adjacent to the major streams and in the steeper areas that cannot be easily farmed (fig. 12). Significant areas of range are along the Republican River. The grass species in the areas of range are essentially the same as those of 100 years ago. Changes in the plant community result from environmental changes or cultural influences.

Figure 12.—An area of the moderately sloping to very steep Colby soils used as range. These soils make up nearly 32 percent of the county.

The county has about 40,000 head of livestock. Cow-calf enterprises are dominant, but some of the ranches are quality purebred cow-calf enterprises or stocker enterprises. Also, 8,000 to 10,000 head of cattle are full fed each year in local feedlots. The native range is well suited to these livestock enterprises.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a

seasonal high water table also are important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Nearly all of the livestock management programs in the county rely on native range from mid-May through late October. In mid-August the protein level of the native grasses begins to drop below the daily requirements of the livestock. Protein supplements are needed during this period. The nutrition needs of the livestock should be carefully monitored during this critical period. A proper stocking rate, a uniform distribution of grazing, and a scheduled deferment of grazing during the growing season are needed.

Native Woodland, Windbreaks, and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

About 4,400 acres in Cheyenne County, or less than 1 percent of the total acreage, is forested *(6)*. The woodland occurs mainly as a gallery forest in areas along the Republican River. These areas are in the Bridgeport-Bankard-Glenberg soil association, which is described under the heading "General Soil Map Units." Some wooded strips are along other major streams, such as Hackberry, Big Timber, and Beaver Creeks. Wet areas in upland drainageways support only a few scattered trees or clumps of trees. The steep breaks in the Colby-Razor association generally support some shrubs. Commercial use of the wooded areas for wood products is very limited because the woodland does not occur in large concentrations.

Plains cottonwood is the dominant species along the streams and rivers and in the upland drainageways. It makes up at least 90 percent of the stocking in many areas. Other species include peachleaf willow, hackberry, boxelder, sandbar willow, Russian olive, mulberry, honeylocust, indigobush, and American plum.

The dominant shrubs on the steep breaks are fragrant sumac, American plum, common chokecherry, golden currant, rabbitbrush, and western snowberry. Chickasaw plum, rabbitbrush, and western snowberry grow in a few scattered areas of sandy soils used for range.

Trees grow on most of the farmsteads and ranch headquarters in Cheyenne County (fig. 13). The county has very few field windbreaks or shelterbelts. It has some timber claim plantings, which were established after the Timber Culture Act of 1873.

Eastern redcedar and Siberian elm are the dominant species grown as windbreaks and environmental plantings. Siberian elm was extensively planted in the older windbreaks. The dominant species in most of the more recent windbreaks are eastern redcedar and Rocky Mountain juniper. Other trees and shrubs include honeylocust, hackberry, Russian olive, Austrian pine,

Figure 13.—A farmstead windbreak on a Ulysses silt loam.

ponderosa pine, Russian mulberry, boxelder, green ash, black locust, lilac, tamarisk, American plum, and cotoneaster.

Tree planting is a continual need because short-lived trees, such as Siberian elm, pass maturity and deteriorate, because some trees are destroyed by insects, disease, or storms, and because new plantings are needed in areas where farming or ranching is expanding. Where Siberian elm is the main species, supplemental planting of evergreen trees and shrubs is needed to provide adequate protection against the wind. Renovation measures, such as removal and replacement or supplemental planting, help to maintain the effectiveness of the windbreak.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the soils on the site should be suited to the trees and shrubs selected for planting. Permeability, available water capacity, fertility, soil depth, and texture greatly affect the growth rate.

Establishing trees and shrubs is difficult in Cheyenne County. The moisture supply is usually short during the growing season, and hot, drying winds are common. Unsuccessful windbreaks and environmental plantings result mainly from the dry conditions and from plant competition. Proper site preparation before planting and control of competing weeds and grasses after planting are important concerns in establishing and maintaining a windbreak. Supplemental watering is needed during dry periods, and cover crops are needed to protect the surface against hot winds.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and

gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Cheyenne County has several areas of scenic, geologic, and historic interest. Scenic views of cropland, rolling grassland, and rocky bluffs are available throughout the county. The landscape in the northern part of the county is unique. It is characterized by extremely rough areas, including steep escarpments. Also, this part of the county has some shrubs and other plants that are rare in Kansas. Pheasants, wild turkeys, cottontail rabbits, and deer are throughout the county. The woodland along the Republican River supports some unusual plants.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than

once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Cheyenne County are pheasant, cottontail rabbit, white-tailed deer, and mule deer. Bobwhite quail are hunted along the streams. Some raccoons, opossums, and coyotes are trapped in the county.

Nongame species are numerous because of the diversity of habitat types in the county. Cropland, grassland, and woodland are intermixed throughout the county. This intermixture creates the desirable edge effect conducive to a variety of wildlife species. Establishing additional fringe areas generally increases the wildlife population. A good windbreak can provide winter cover for several pheasants and cottontails, a covey of quail, and many songbirds.

Fishing in Cheyenne County is limited to a few farm ponds and sand pits. Two water-filled sand pits are in the St. Francis Wildlife Area, near St. Francis (fig. 14). This wildlife area is managed by the Kansas Fish and Game Commission. The species commonly caught are channel catfish, bullheads, bass, and bluegill.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, grain sorghum, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are bluestem, grama, goldenrod, switchgrass, sunflowers, ragweed, and wheatgrass.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are sandhill sage, sandbur, willow, currant, plum, prairie rose, and fragrant sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity,

Figure 14.—A water-filled sand pit in the St. Francis Wildlife Area.

slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include pheasant, meadowlark, field sparrow, and cottontail.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to

rangeland include mule deer, prairie chickens, hawks, meadowlarks, and prairie dogs.

Technical assistance in planning wildlife areas and in determining the vegetation suitable for planting can be obtained from the local office of the Soil Conservation Service. Additional information and assistance can be obtained from the Kansas Fish and Game Commission and from the Cooperative Extension Service.

Engineering

John Eberwein, civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a

seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high

content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable

quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water

movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock, affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

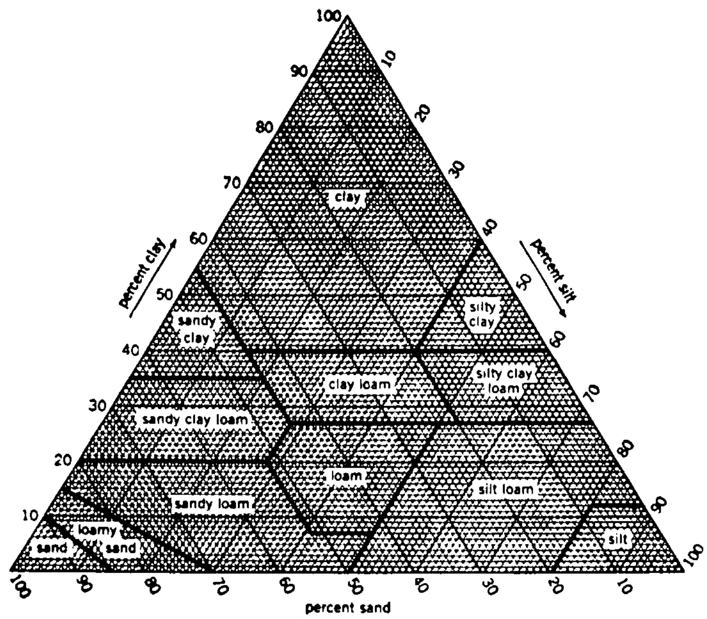

Figure 15.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 15). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic

matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available

water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous, loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the

soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and

on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Kansas Department of Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(5)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent dryness, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Agri*, meaning argillic horizon, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that is drier than is typical for the great group. An example is Aridic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Aridic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (4)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (5)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Bankard Series

The Bankard series consists of deep, somewhat excessively drained, rapidly permeable soils on flood plains. These soils formed in sandy and loamy alluvium. Slopes range from 0 to 2 percent.

Bankard soils are similar to Dwyer soils and are commonly adjacent to Bridgeport, Caruso, Glenberg, and Las Animas soils. The excessively drained Dwyer soils are on uplands. Bridgeport soils have a mollic epipedon and are more silty than the Bankard soils. They are on the slightly higher flood plains and stream terraces. The somewhat poorly drained Caruso and Las Animas soils are in positions on the flood plains similar to those of the Bankard soils. Caruso soils have a mollic epipedon. Las Animas soils have a fluctuating water table. The well drained Glenberg soils are on the slightly higher stream terraces. Their subsoil is less sandy than that of the Bankard soils.

Typical pedon of Bankard loamy fine sand, occasionally flooded, 500 feet south and 100 feet east of the northwest corner of sec. 10, T. 1 S., R. 42 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common fine and medium roots; about 5 percent gravel; strong effervescence; mildly alkaline; clear smooth boundary.

C1—6 to 16 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; loose; few fine roots; about 5 percent gravel; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—16 to 60 inches; very pale brown (10YR 7/3) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few thin strata of dark grayish brown sandy loam; about 14 percent gravel; strong effervescence; moderately alkaline.

The A horizon has hue of 2.5Y to 7.5YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4. It is typically loamy fine sand, but the range includes sandy loam and sand. The C horizon has hue of 2.5Y to 7.5YR, value of 6 or 7 (4 or 5 moist), and chroma of 3 or 4. It is dominantly fine sand, loamy fine sand, sand, or gravelly sand but has a few strata of loamy material.

Bridgeport Series

The Bridgeport series consists of deep, well drained, moderately permeable soils on stream terraces and flood plains. These soils formed in calcareous, silty alluvium. Slopes range from 0 to 5 percent.

Bridgeport soils are similar to Goshen soils and are commonly adjacent to Bankard, Colby, Glenberg, Kim, and Las Animas soils. The somewhat excessively drained, sandy Bankard soils are on the lower flood plains. Colby and Kim soils are on uplands. They do not have a mollic epipedon. Also, Colby soils have a silty subsoil, and Kim soils have a loamy subsoil. The well drained Glenberg soils are on stream terraces. They are more sandy than the Bridgeport soils. Goshen soils have a mollic epipedon that is more than 20 inches thick. They are in swales and narrow drainageways on uplands. The somewhat poorly drained Las Animas soils are on flood plains.

Typical pedon of Bridgeport silt loam, 0 to 2 percent slopes, 1,000 feet south and 200 feet west of the northeast corner of sec. 10, T. 1 S., R. 42 W.

A1—0 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; few worm casts; slight effervescence; moderately alkaline; gradual smooth boundary.

A2—12 to 16 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; few worm casts; strong effervescence; moderately alkaline; gradual smooth boundary.

Bw—16 to 26 inches; grayish brown (10YR 5/2) silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

BC—26 to 34 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C—34 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; hard, friable; few fine roots; few fine pores; few thin strata of dark grayish brown sandy loam; few threads and films of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 35 inches. The depth to lime ranges from 0 to 15 inches. Reaction typically is mildly alkaline or moderately alkaline throughout the profile, but it ranges from neutral to moderately alkaline.

The A horizon has value of 3 to 5 (2 or 3 moist) and

chroma of 1 to 3. It is typically silt loam, but the range includes loam, fine sandy loam, clay loam, and silty clay loam. The Bw and C horizons are dominantly silt loam, silty clay loam, or loam. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. Contrasting sandy or clayey strata, mottles, or buried soils are below a depth of 40 inches in some pedons.

Canyon Series

The Canyon series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy material weathered from weakly cemented limestone or very fine grained sandstone. Slopes range from 5 to 30 percent.

Canyon soils are commonly adjacent to Colby, Kim, Otero, and Ulysses soils. The adjacent soils are more than 40 inches deep over bedrock. The silty Colby and Ulysses soils are higher on the landscape than the Canyon soils. Kim soils are on side slopes above or below the Canyon soils. Otero soils are more sandy than the Canyon soils. They are in positions on the landscape similar to those of the Canyon soils.

Typical pedon of Canyon loam, in an area of Canyon-Kim loams, 5 to 30 percent slopes; 500 feet west and 50 feet south of the northeast corner of sec. 20, T. 3 S., R. 41 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; many fine roots; about 5 percent caliche fragments 2 to 20 millimeters in diameter; violent effervescence; moderately alkaline; abrupt smooth boundary.

AC—5 to 9 inches; pale brown (10YR 6/3) gravelly loam, dark brown (10Y 4/3) moist; weak medium prismatic structure parting to moderate fine granular; soft, friable; many fine roots; about 20 percent caliche fragments 2 to 20 millimeters in diameter; violent effervescence; moderately alkaline; clear smooth boundary.

C—9 to 14 inches; light gray (2.5Y 7/2) gravelly loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable; few fine roots; about 25 percent caliche fragments 2 to 30 millimeters in diameter; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—14 inches; white (2.5Y 8/2), weakly cemented, fine grained sandstone and some hard caliche; violent effervescence.

The solum is 6 to 12 inches thick. The depth to bedrock ranges from 6 to 20 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile. The content of coarse fragments ranges from 0 to 25 percent throughout.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. It is typically loam, but the range includes gravelly loam and gravelly sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 7 moist), and chroma of 2 to 4.

Caruso Series

The Caruso series consists of deep, somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in loamy and silty alluvium. Slopes range from 0 to 2 percent.

Caruso soils are commonly adjacent to Bankard, Bridgeport, and Las Animas soils. The somewhat excessively drained, sandy Bankard soils are in positions on the landscape similar to those of the Caruso soils. The well drained Bridgeport soils are on the slightly higher stream terraces. They have a silty subsoil. Las Animas soils are more sandy than the Caruso soils. Also, they are on lower flood plains.

Typical pedon of Caruso silty clay loam, occasionally flooded, 2,500 feet north and 500 feet east of the southwest corner of sec. 26, T. 5 S., R. 37 W.

A1—0 to 10 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; very hard, firm; common fine roots; few worm casts; strong effervescence; moderately alkaline; clear smooth boundary.

A2—10 to 19 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure parting to moderate medium granular; hard, friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—19 to 28 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; few fine prominent strong brown (7.5YR 5/6) mottles; moderate fine granular structure; hard, friable; few fine roots; about 2 percent coarse sand grains; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—28 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; common fine faint yellowish brown (10YR 5/4) mottles; massive; hard, friable; few fine roots; few thin strata of loamy sand; violent effervescence; moderately alkaline.

The thickness of the solum and of the mollic epipedon ranges from 10 to 20 inches. The depth to lime ranges from 0 to 10 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile. Mottles in various shades of brown are below a depth of 18 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silty clay loam and clay loam, but the range includes silt loam and sandy loam. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 1 to 3. It is dominantly loam, silt loam, or clay loam. In some pedons, however, contrasting strata of sandy or clayey material are below a depth of 40 inches.

Colby Series

The Colby series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 50 percent.

Colby soils are similar to Ulysses soils and are commonly adjacent to Canyon, Kim, Midway, Otero, and Ulysses soils. Ulysses soils have a mollic epipedon. They are generally in the less sloping areas above the Colby soils. Canyon, Kim, Midway, and Otero soils are lower on the landscape than the Colby soils. Canyon soils are 10 to 20 inches deep over bedrock. Midway soils are shallow over clayey shale. Kim soils contain more sand in the subsoil than the Colby soils. The somewhat excessively drained Otero soils are more sandy than the Colby soils.

Typical pedon of Colby silt loam, 6 to 20 percent slopes, 500 feet west and 100 feet south of the northeast corner of sec. 18, T. 5 S., R. 37 W.

A—0 to 5 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

AC—5 to 11 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—11 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few fine roots and root channels; many fine pores; few fine accumulations of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—20 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; few fine roots; common fine accumulations of lime; violent effervescence, moderately alkaline.

The solum is 3 to 12 inches thick. Typically, lime is throughout the profile, but some pedons do not have lime in the upper 6 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It is typically silt loam, but in some pedons it is loam. The AC and C horizons have hue of 10YR or 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. They are silt loam or loam.

Dwyer Series

The Dwyer series consists of deep, excessively drained, rapidly permeable soils on dunes and foot slopes. These soils formed in sandy eolian material. Slopes range from 3 to 15 percent.

Dwyer soils are similar to Bankard soils and are commonly adjacent to Bankard, Glenberg, Manter, and Otero soils. The somewhat excessively drained Bankard soils are on flood plains. The loamy Glenberg soils are on stream terraces. The loamy Manter soils have a mollic epipedon. They are on the slightly higher uplands. The loamy Otero soils have a calcareous surface layer. They are on the more sloping parts of the landscape.

Typical pedon of Dwyer loamy fine sand, rolling, 1,000 feet south and 300 feet east of the northwest corner of sec. 21, T. 4 S., R. 41 W.

A—0 to 8 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—8 to 16 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—16 to 60 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grained; loose; very few fine roots; strong effervescence; moderately alkaline.

The A horizon has hue of 2.5Y or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. In areas where it has mollic colors, it is too thin or contains too little organic matter to qualify as a mollic epipedon. It typically is mildly alkaline to strongly alkaline but ranges

from slightly acid to strongly alkaline. The C horizon has hue of 2.5Y to 7.5YR. It is moderately alkaline or strongly alkaline.

Glenberg Series

The Glenberg series consists of deep, well drained, moderately rapidly permeable soils on stream terraces. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Glenberg soils are similar to Manter soils and are commonly adjacent to Bankard, Bridgeport, Caruso, and Las Animas soils. Bankard soils have a sandy subsoil. They are on flood plains. Bridgeport soils have a silty subsoil. They are in positions on the landscape similar to those of the Glenberg soils. Caruso and Manter soils have a mollic epipedon. The somewhat poorly drained Caruso soils are on flood plains, and the well drained Manter soils are on uplands. The somewhat poorly drained Las Animas soils are on flood plains.

Typical pedon of Glenberg fine sandy loam, 1,900 feet east and 200 feet south of the northwest corner of sec. 21, T. 4 S., R. 41 W.

A—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; very friable; many fine roots; few pebbles 2 to 5 millimeters in diameter; weak effervescence; moderately alkaline; gradual smooth boundary.

AC—8 to 16 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; common fine roots; few pebbles 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—16 to 42 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; many fine roots; stratified with thin lenses of loam and loamy sand; few pebbles 2 to 5 millimeters in diameter; soft accumulations of lime; violent effervescence; moderately alkaline; abrupt smooth boundary.

C2—42 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; thin layers of lime; violent effervescence; moderately alkaline.

The depth to lime is less than 10 inches, and most pedons are calcareous to the surface. The A horizon has hue of 2.5Y or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. It is typically fine sandy loam, but the range includes loamy sand, loamy fine sand, and sandy loam. The C horizon has hue of 2.5Y to 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3.

Goshen Series

The Goshen series consists of deep, well drained, moderately permeable soils in swales and narrow drainageways on uplands. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Goshen soils are similar to Bridgeport soils and are commonly adjacent to Bridgeport, Colby, Keith, Kuma, and Ulysses soils. Bridgeport and Ulysses soils have a mollic epipedon that is less than 20 inches thick. Colby soils do not have a mollic epipedon. Keith soils are noncalcareous to a depth of more than 14 inches. Kuma soils have lime at a depth of 14 to 35 inches. Colby, Keith, Kuma, and Ulysses soils are higher on the landscape than the Goshen soils.

Typical pedon of Goshen silt loam, 1,300 feet east and 100 feet south of the northwest corner of sec. 19, T. 4 S., R. 38 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common fine roots; neutral; abrupt smooth boundary.

A—5 to 16 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; neutral; clear smooth boundary.

Bt1—16 to 28 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable; many fine roots; few faint clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—28 to 42 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; common fine roots; few faint clay films on faces of peds; neutral; gradual smooth boundary.

Bk—42 to 54 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; many fine threads and soft masses of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C—54 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; slightly hard,

friable; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to lime range from 35 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 32 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is typically silt loam, but in some pedons it is loam. It ranges from slightly acid to mildly alkaline. The Bt horizon has value of 4 to 6 (2 to 5 moist) and chroma of 2 or 3. It is typically neutral or mildly alkaline but ranges from neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 6 moist), and chroma of 2 or 3. It is silt loam or loam.

Keith Series

The Keith series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes are 0 to 1 percent.

Keith soils are similar to Kuma and Ulysses soils and are commonly adjacent to Kuma, Satanta, and Ulysses soils. All of the adjacent soils are in positions on the landscape similar to those of the Keith soils. Kuma soils have a mollic epipedon that is more than 20 inches thick. Satanta soils contain more sand in the subsoil than the Keith soils. Ulysses soils do not have an argillic horizon.

Typical pedon of Keith silt loam, 0 to 1 percent slopes, 1,000 feet south and 200 feet west of the northeast corner of sec. 22, T. 2 S., R. 38 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, friable; many fine roots; slightly acid; abrupt smooth boundary.

A2—4 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; slightly acid; clear smooth boundary.

Bt1—10 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common fine roots; few faint clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—18 to 24 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots; few faint clay films faces of peds; neutral; clear smooth boundary.

BC—24 to 32 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; soft, very friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C—32 to 60 inches; light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; few fine roots; few accumulations and streaks of lime; strong effervescence; moderately alkaline.

The solum ranges from 16 to 48 inches in thickness. The mollic epipedon ranges from 8 to 20 inches in thickness. The depth to lime ranges from 15 to 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but in some pedons it is loam. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is silt loam, silty clay loam, or loam. It ranges from neutral to moderately alkaline. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 to 4. It is silt loam or loam. It is mildly alkaline or moderately alkaline.

Kim Series

The Kim series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy old alluvium. Slopes range from 1 to 15 percent.

Kim soils are commonly adjacent to Canyon, Colby, Otero, Razor, and Ulysses soils. Canyon soils are 10 to 20 inches deep over bedrock. They are in the steeper areas. Colby and Ulysses soils have a silty subsoil. They are higher on the landscape than the Kim soils. The somewhat excessively drained Otero soils are in positions on the landscape similar to those of the Kim soils. They are more sandy than the Kim soils. Razor soils are 20 to 40 inches deep over clayey shale. They are on small knolls and the lower side slopes.

Typical pedon of Kim loam, 3 to 6 percent slopes, 1,500 feet south and 300 feet east of the northwest corner of sec. 29, T. 4 S., R. 41 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

AC—6 to 16 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; hard, friable; many fine roots;

strong effervescence; moderately alkaline; clear smooth boundary.

C—16 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; hard, friable; few fine roots; about 5 percent of horizon made up of thin strata of sand and a few pebbles; visible threads and masses of lime; violent effervescence; moderately alkaline.

The solum is 10 to 18 inches thick. The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. It is typically loam, but in some pedons it is clay loam. The C horizon has hue of 5Y to 7.5YR, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4. It is loam or clay loam.

Kuma Series

The Kuma series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes are 0 to 1 percent.

Kuma soils are similar to Keith soils and are commonly adjacent to those soils. Keith soils have a mollic epipedon that is less than 20 inches thick. They are in positions on the landscape similar to those of the Kuma soils.

Typical pedon of Kuma silt loam, 0 to 1 percent slopes, 2,000 feet east and 200 feet south of the northwest corner of sec. 7, T. 3 S., R. 37 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; few worm casts; mildly alkaline; abrupt smooth boundary.

BA—5 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; mildly alkaline; gradual smooth boundary.

Bt—15 to 29 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; slightly hard, firm; common fine roots; few faint clay films on faces of peds; few worm casts; mildly alkaline; gradual smooth boundary.

Bkb—29 to 50 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; slightly hard, friable; few fine roots; many fine threads and soft masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C—50 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. The mollic epipedon ranges from 20 to 50 inches in thickness. The depth to lime ranges from 14 to 35 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It ranges from slightly acid to moderately alkaline. The Bt and Bkb horizons are silt loam or silty clay loam. The Bt horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bkb horizon has hue of 10YR or 7.5YR, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. The C horizon has hue of 10YR or 7.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Las Animas Series

The Las Animas series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in loamy and sandy, calcareous, stratified alluvium. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Las Animas soils are commonly adjacent to Bankard, Bridgeport, Caruso, and Glenberg soils. The somewhat excessively drained Bankard soils are in positions on the flood plains similar to those of the Las Animas soils. The silty Bridgeport soils and the well drained Glenberg soils are on the slightly higher parts of stream terraces. Bridgeport soils have a mollic epipedon. The moderately well drained Caruso soils are on the higher flood plains. They are more clayey than the Las Animas soils.

Typical pedon of Las Animas loam, occasionally flooded, 1,700 feet north and 1,000 feet west of the southeast corner of sec. 29, T. 3 S., R. 40 W.

A—0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

AC—6 to 14 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium granular structure; hard, friable; many fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—14 to 20 inches; light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; few fine prominent

yellowish brown (10YR 5/6) mottles; massive; hard, friable; streaks and masses of lime; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—20 to 32 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; few fine prominent yellowish brown (10YR 5/6) mottles; massive; soft, loose; few fine roots; thin strata of loam; strong effervescence; moderately alkaline; abrupt wavy boundary.

2C—32 to 60 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; many fine prominent reddish yellow (7.5YR 6/6) mottles; single grained; loose; thin strata of loam; strong effervescence; moderately alkaline.

The solum is 8 to 18 inches thick. Depth to the sandy 2C horizon ranges from 25 to 40 inches.

The A horizon has hue of 5Y to 7.5YR or is neutral in hue. It has value of 4 to 6 (3 or 4 moist) and chroma of 0 to 2. It is typically loam, but the range includes fine sandy loam and clay loam. The C and 2C horizons have hue of 5Y to 7.5YR, value of 5 to 7 (4 or 5 moist), and chroma of 1 to 3.

Manter Series

The Manter series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy old alluvium or in loamy eolian material. Slopes range from 2 to 5 percent.

Manter soils are similar to Glenberg soils and are commonly adjacent to Otero, Satanta, and Ulysses soils. Glenberg and Otero soils do not have a mollic epipedon. Satanta and Ulysses contain less sand in the subsoil than the Manter soils. Satanta soils are on ridgetops and the lower side slopes. The silty Ulysses soils are on the upper side slopes.

Typical pedon of Manter fine sandy loam, 2 to 5 percent slopes, 600 feet west and 500 feet north of the southeast corner of sec. 29, T. 4 S., R. 41 W.

A—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; common fine roots; neutral; clear smooth boundary.

AB—10 to 18 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; common fine roots; neutral; clear smooth boundary.

Bt—18 to 24 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; few fine roots; few faint clay films on faces of peds; many worm casts; neutral; clear smooth boundary.

BC—24 to 34 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; few accumulations of lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C—34 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 7 to 19 inches. The depth to lime ranges from 12 to 40 inches.

The A horizon has hue of 5Y to 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. The Bt and C horizons have hue of 5Y to 7.5YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. The content of gravel ranges from 0 to 15 percent in the Bt horizon.

Midway Series

The Midway series consists of shallow, well drained, slowly permeable soils on uplands. These soils formed in material weathered from calcareous shale. Slopes range from 5 to 20 percent.

Midway soils are commonly adjacent to Canyon, Colby, Kim and Razor soils. The loamy Canyon soils are on the steeper slopes above the Midway soils. Colby and Kim soils are more than 40 inches deep over bedrock. They are higher on the landscape than the Midway soils. Razor soils are 20 to 40 inches deep over bedrock. They are in the less sloping areas, generally above the Midway soils.

Typical pedon of Midway silty clay loam, in an area of Razor-Midway silty clay loams, 5 to 20 percent slopes; 2,500 feet west and 1,800 feet south of the northeast corner of sec. 10, T. 1 S., R. 42 W.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; very hard, extremely firm; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C—4 to 12 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; very hard, extremely

firm; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—12 to 20 inches; pale yellow (2.5Y 7/4), calcareous clay shale, light yellowish brown (2.5Y 6/4) moist.

The depth to shale ranges from 10 to 20 inches. The A and C horizons have hue of 2.5Y or 10YR, value of 5 or 6 (3 to 5 moist), and chroma of 2 to 4.

Otero Series

The Otero series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy, calcareous old alluvium. Slopes range from 5 to 15 percent.

Otero soils are commonly adjacent to Bankard, Canyon, Kim, and Manter soils. The sandy Bankard soils are on low flood plains. The shallow Canyon soils are on side slopes above the Otero soils. Kim soils have more clay in the subsoil than the Otero soils. Also, they are higher on the landscape. Manter soils have a mollic epipedon. They are in the less sloping areas.

Typical pedon of Otero fine sandy loam, 5 to 15 percent slopes, 2,500 feet east and 500 feet north of the southwest corner of sec. 9, T. 1 S., R. 42 W.

A—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; common fine roots; about 5 percent gravel; strong effervescence; moderately alkaline; clear smooth boundary.

AC—8 to 16 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak medium granular; slightly hard, very friable; common fine roots; about 2 percent gravel; strong effervescence; moderately alkaline; gradual smooth boundary.

C—16 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few fine roots; about 5 to 10 percent gravel; few soft accumulations of lime; violent effervescence; moderately alkaline.

The texture is sandy loam or fine sandy loam throughout the profile. The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 to 4. The C horizon has hue of 5Y to 7.5YR, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4.

Pleasant Series

The Pleasant series consists of deep, moderately well drained, very slowly permeable soils in small depressions on uplands. These soils formed in loess. Slopes are 0 to 1 percent.

Pleasant soils are commonly adjacent to Keith and Kuma soils. The adjacent soils are slightly higher on the landscape than the Pleasant soils. Also, they have a less clayey subsoil.

Typical pedon of Pleasant silty clay loam, 2,600 feet south and 1,400 feet east of the northwest corner of sec. 3, T. 3 S., R. 42 S.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, firm; many fine roots; neutral; abrupt smooth boundary.

A—4 to 8 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine granular; very hard, very firm; many fine roots; neutral; clear smooth boundary.

Bt1—8 to 15 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; extremely hard, very firm; many fine roots; few faint clay films on faces of peds; mildly alkaline; gradual smooth boundary.

Bt2—15 to 22 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate fine subangular blocky; extremely hard, very firm; many fine roots; few faint clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bt3—22 to 32 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; moderate medium angular blocky structure; hard, firm; few fine roots; few faint clay films on faces of peds; mildly alkaline; gradual smooth boundary.

BC—32 to 50 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; few fine roots; mildly alkaline; gradual smooth boundary.

C—50 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; few fine roots; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to lime range from 50 to more than 60 inches. The mollic epipedon ranges from 20 to 50 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is typically silty clay loam, but in some pedons it is silt loam. The Bt horizon has value of

4 to 7 (2 to 6 moist) and chroma of 1 to 3. It is silty clay loam, silty clay, or clay. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 to 5. Some pedons have dark buried horizons below a depth of 40 inches.

Razor Series

The Razor series consists of moderately deep, well drained, slowly permeable soils on uplands. These soils formed in material weathered from calcareous shale. Slopes range from 3 to 12 percent.

Razor soils are adjacent to Colby, Kim, and Midway soils. Midway soils are 10 to 20 inches deep over bedrock. They are on the steeper side slopes. The silty Colby soils are more than 40 inches deep over bedrock. They are on side slopes above the Razor soils. The deep Kim soils do not have a mollic epipedon. They are on the upper side slopes.

Typical pedon of Razor silty clay loam, in an area of Razor-Midway silty clay loams, 5 to 20 percent slopes; 1,900 feet south and 2,000 feet west of the northeast corner of sec. 14, T. 1 S., R. 42 W.

A—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure parting to moderate very fine granular; hard, friable; many fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

Bw1—4 to 9 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak fine prismatic structure parting to moderate fine angular blocky; very hard, very firm; many fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

Bw2—9 to 18 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; moderate fine prismatic structure parting to moderate fine angular blocky; very hard, very firm; many fine roots; few worm casts; thin patchy shiny compression surfaces on peds; strong effervescence; moderately alkaline; gradual smooth boundary.

BCk—18 to 26 inches; light yellowish brown (10YR 6/4) silty clay, light olive brown (2.5Y 5/4) moist; moderate fine prismatic structure parting to weak medium angular blocky; very hard, very firm; many small soft masses of lime; violent effervescence; moderately alkaline; clear smooth boundary.

C—26 to 32 inches; light yellowish brown (2.5Y 6/4) silty clay, light olive brown (2.5Y 5/4) moist; weak fine prismatic structure; very hard, firm; few fine roots; common fine and medium shale fragments; common small masses of lime; strong effervescence; moderately alkaline; abrupt wavy boundary.

Cr—32 to 36 inches; light brownish gray (2.5Y 6/2) silty clay shale, dark grayish brown (2.5Y 4/2) moist; strong medium platy structure.

The thickness of the solum ranges from 20 to 36 inches. The depth to bedrock ranges from 20 to 40 inches. The texture is clay, silty clay loam, or silty clay throughout the profile.

The A horizon has hue of 5Y to 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It ranges from neutral to moderately alkaline. The B and C horizons are mildly alkaline or moderately alkaline. The Bw horizon has hue of 5Y to 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 2 to 4. The C horizon has hue of 5Y to 10YR, value of 5 to 8 (4 to 6 moist), and chroma of 2 to 4.

Satanta Series

The Satanta series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy eolian material or in loamy old alluvium. Slopes range from 0 to 3 percent.

Satanta soils are commonly adjacent to Keith, Kim, Manter, and Ulysses soils. Keith and Ulysses soils have a silty subsoil. Keith soils are in nearly level areas. Ulysses soils are in the smoother, less undulating areas. The deep Kim soils do not have a mollic epipedon. They are on the steeper side slopes. Manter soils contain less clay in the subsoil than the Satanta soils. They are on the more rolling slopes.

Typical pedon of Satanta loam, 0 to 1 percent slopes, 100 feet north and 500 feet west of the southeast corner of sec. 25, T. 4 S., R. 42 W.

A—0 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; many worm casts in the lower part; neutral; clear smooth boundary.

BA—10 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common fine roots; few worm casts; neutral; gradual smooth boundary.

Bt—16 to 23 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist;

moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable; few fine roots; few faint clay films on faces of peds; few worm casts; neutral; abrupt smooth boundary.

Bk—23 to 32 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; few fine roots; films of segregated lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C—32 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, friable; few fine roots; many fine pores; films of lime in seams; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to lime ranges from 15 to 36 inches. The mollic epipedon is 8 to 20 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes very fine sandy loam, clay loam, and fine sandy loam. This horizon ranges from slightly acid to mildly alkaline. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is clay loam, loam, or sandy clay loam. It ranges from neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is clay loam, loam, sandy clay loam, or very fine sandy loam. It is mildly alkaline or moderately alkaline.

Ulysses Series

The Ulysses series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 3 percent.

Ulysses soils are similar to Colby and Keith soils and are commonly adjacent to Colby, Keith, and Kim soils. Colby and Kim soils do not have a mollic epipedon. They are on the steeper slopes, generally below the Ulysses soils. Keith soils have an argillic horizon. They are on broad upland flats.

Typical pedon of Ulysses silt loam, 1 to 3 percent slopes, 200 feet east and 100 feet south of the northwest corner of sec. 12, T. 5 S., R. 38 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many fine roots; mildly alkaline; clear smooth boundary.

A—5 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; mildly alkaline; gradual smooth boundary.

Bw—12 to 22 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—22 to 30 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; films and streaks of lime; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—30 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few fine roots; few fine threads and soft accumulations of lime; strong effervescence; moderately alkaline.

The solum ranges from 10 to 24 inches in thickness. It is silt loam, loam, or silty clay loam. The depth to lime is 7 to 15 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is neutral or mildly alkaline. The Bw horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of a soil at any given point are determined by the interaction of five factors of soil formation—climate, plants and other living organisms, parent material, relief, and time. Each of these factors influences the formation of every soil, and each modifies the effects of the other four. The relative effects of the individual factors vary from place to place. The interactions among these factors are more complex for some soils than for others.

Parent Material

Parent material is the unconsolidated material in which soils form. It either is material weathered from rocks through freezing and thawing, abrasion, erosion, or chemical processes or is material deposited by wind or water. The parent material affects texture, structure, color, natural fertility, and many other soil properties. Soils differ partly because of the various kinds of parent material. The texture of the parent material influences the rate of the downward movement of water and air and thus greatly affects soil formation. The composition of the parent material largely determines the mineralogical composition of the soil and, hence, its natural fertility. The soils in Cheyenne County formed in alluvium, sandy eolian material, loess, and material weathered from weakly cemented limestone, lime-cemented sandstone, and shale.

Alluvium is water-deposited material. Both recent and old alluvial sediments are evident in Cheyenne County. The recent alluvium is in stream valleys. Bankard, Bridgeport, Caruso, Glenberg, and Las Animas soils formed in this material. Old alluvial sediments are on what are now uplands. Kim and Otero soils formed in these sediments.

Sandy eolian material was deposited by the wind in some areas of the county. Dwyer soils formed in this material.

Loess is silty, wind-deposited material, some of which was carried hundreds of miles from its source. Peorian Loess of the Wisconsin Glaciation, which covers many of the uplands in Cheyenne County, was deposited during the Pleistocene. In most places it is very pale brown or light gray and is calcareous and friable. Colby, Keith, Kuma, and Ulysses soils formed in this material.

The bedrock that crops out in Cheyenne County consists mainly of weakly cemented limestone or shale of the Upper Cretaceous System. The calcareous Canyon soils formed in material weathered from weakly cemented limestone or very fine grained sandstone. Midway and Razor soils formed in material weathered from Pierre Shale.

Climate

Climate is an active factor of soil formation. It directly influences soil formation by weathering the parent material. It indirectly affects soil formation through its effect on plants and animals. Soil-forming processes are most active when the soil is warm and moist.

The climate of Cheyenne County is typical continental. It is characterized by intermittent dry and moist periods, which can last for less than a year or for several years. The soil material dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become so saturated that excess moisture penetrates the substratum. Because of the wetting and drying, some of the basic nutrients, and even clay particles, have been leached from the upper horizons of soils. An accumulation of lime in the lower part of the subsoil in Kuma soils is an indication of leaching by excess moisture. The downward movement of water is a major factor in transforming the parent material into a soil that has distinct horizons.

Plant and Animal Life

Plants and animals have important effects on soil formation. Plants generally influence the content of nutrients and organic matter in the soil and the color of the surface layer. Earthworms, cicadas, and other

burrowing animals help to keep the soil open and porous. Bacteria and fungi help to decompose the plants, thus releasing plant nutrients.

Mid and tall prairie grasses have had an influence on soil formation in Cheyenne County. As a result of the grasses, the upper part of a typical soil in the county is dark and is high in content of organic matter. In many areas the next layer is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color.

Human activities have greatly affected soil formation. In most areas they have increased the susceptibility to erosion, increased or decreased the organic matter content, or changed relief through land leveling and through industrial and urban development.

Relief

Relief, or lay of the land, influences the formation of soils through its effect on drainage, runoff, plant cover, and soil temperature. It is important mainly because it controls the movement of water on the surface and into the soil.

Runoff is more rapid on the steeper soils in the uplands than on the less sloping soils. As a result, erosion is more extensive. Canyon soils formed in old parent material, but relief has restricted their formation. Runoff is rapid on these strongly sloping to steep soils, and much of the soil material is removed as soon as a soil forms.

Time

The length of time needed for soil formation depends largely on the other factors of soil formation. As water moves downward through the soil, soluble material and fine particles are gradually leached from the surface layer to the subsoil. The amount of leaching depends on the amount of time that has elapsed and the amount of water that has penetrated the surface.

Differences in the length of time that the parent material has been exposed to the processes of soil formation are reflected in the degree of profile development. For example, the young Bridgeport soils, which formed in recent alluvium, show very little evidence of horizon development other than a slight darkening of the surface layer. In contrast, the older Keith soils, which have been exposed to soil-forming processes for thousands of years, have well defined horizons.

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor

drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has

distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is

allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the

potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The

degrees of sodicity and their respective ratios are—

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These

changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1941-70 at St. Francis, Kansas)

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	In	In	In		In
January----	44.7	15.8	30.3	73	-11	0.46	0.06	0.66	1	5.5
February---	49.0	20.3	34.7	80	-6	.45	.05	.75	1	5.0
March------	54.4	24.5	39.5	86	1	1.10	.33	1.47	3	8.4
April------	67.1	36.4	51.8	90	15	1.63	.69	2.09	4	3.0
May--------	75.8	46.9	61.4	96	29	3.08	1.38	4.18	6	.4
June-------	85.1	56.6	70.9	105	41	2.92	1.47	4.45	6	.0
July-------	91.6	62.8	77.2	106	49	2.74	1.57	3.65	5	.0
August-----	90.3	61.2	75.8	104	47	2.28	.69	3.08	5	.0
September--	81.8	50.8	66.3	102	32	1.50	.12	2.27	3	.0
October----	71.3	38.9	55.1	93	20	1.24	.38	1.63	2	2.1
November---	55.7	26.3	41.0	79	0	.62	.17	1.33	2	5.2
December---	46.5	19.1	32.8	72	-10	.43	.14	.77	1	5.7
Year-----	67.8	38.3	53.1	107	-17	18.45	14.15	22.27	39	35.3

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature 24° F or lower	Temperature 28° F or lower	Temperature 32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 22	May 5	May 20
2 years in 10 later than--	Apr. 17	Apr. 30	May 15
5 years in 10 later than--	Apr. 8	Apr. 20	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 14	Oct. 4	Sept. 24
2 years in 10 earlier than--	Oct. 18	Oct. 9	Sept. 28
5 years in 10 earlier than--	Oct. 28	Oct. 18	Oct. 8

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	182	159	134
8 years in 10	190	167	142
5 years in 10	203	181	156
2 years in 10	217	195	171
1 year in 10	225	202	178

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Bc	Bankard loamy fine sand, occasionally flooded	9,690	1.5
Bg	Bridgeport silt loam, 0 to 2 percent slopes	11,050	1.7
Bh	Bridgeport silt loam, 2 to 5 percent slopes	3,350	0.5
Bs	Bridgeport silt loam, channeled	4,100	0.6
Bw	Bridgeport silt loam, occasionally flooded	2,450	0.4
Ca	Canyon-Kim loams, 5 to 30 percent slopes	12,150	1.9
Cf	Caruso silty clay loam, occasionally flooded	1,407	0.2
Co	Colby silt loam, 3 to 6 percent slopes	50,300	7.7
Cp	Colby silt loam, 6 to 20 percent slopes	117,600	18.0
Cs	Colby silt loam, 20 to 50 percent slopes	39,900	6.1
Dw	Dwyer loamy fine sand, rolling	9,650	1.5
Gb	Glenberg fine sandy loam	6,850	1.0
Gn	Goshen silt loam	7,000	1.1
Ka	Keith silt loam, 0 to 1 percent slopes	58,640	9.0
Km	Kim loam, 1 to 3 percent slopes	1,950	0.3
Ko	Kim loam, 3 to 6 percent slopes	4,950	0.8
Kr	Kim-Razor complex, 3 to 6 percent slopes	2,900	0.4
Ku	Kuma silt loam, 0 to 1 percent slopes	116,950	17.9
Lh	Las Animas loam, occasionally flooded	4,420	0.7
Mc	Manter fine sandy loam, 2 to 5 percent slopes	25,750	3.9
Ot	Otero fine sandy loam, 5 to 15 percent slopes	26,350	4.0
Ps	Pleasant silty clay loam	3,450	0.5
Rm	Razor-Midway silty clay loams, 5 to 20 percent slopes	6,300	1.0
Sb	Satanta loam, 0 to 1 percent slopes	10,200	1.6
Sc	Satanta loam, 1 to 3 percent slopes	6,800	1.0
Ua	Ulysses silt loam, 0 to 1 percent slopes	7,000	1.1
Ub	Ulysses silt loam, 1 to 3 percent slopes	102,200	15.6
	Total	653,357	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. Also, nonirrigated areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
Gn	Goshen silt loam (where irrigated)
Ka	Keith silt loam, 0 to 1 percent slopes (where irrigated)
Ku	Kuma silt loam, 0 to 1 percent slopes (where irrigated)
Sb	Satanta loam, 0 to 1 percent slopes (where irrigated)
Sc	Satanta loam, 1 to 3 percent slopes (where irrigated)
Ua	Ulysses silt loam, 0 to 1 percent slopes (where irrigated)
Ub	Ulysses silt loam, 1 to 3 percent slopes (where irrigated)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Winter wheat		Grain sorghum		Alfalfa hay	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons
Bc: Bankard	VIw	---	---	---	---	---	---	---
Bg: Bridgeport	IIc	I	36	55	49	115	3.5	6.0
Bh: Bridgeport	IIIe	IIIe	33	55	45	110	2.0	5.5
Bs: Bridgeport	Vw	---	---	---	---	---	---	---
Bw: Bridgeport	IIw	---	36	---	49	---	3.5	---
Ca: Canyon-Kim	VIs	---	---	---	---	---	---	---
Cf: Caruso	IIw	---	32	---	43	---	3.0	---
Co: Colby	IVe	---	27	---	37	90	---	---
Cp: Colby	VIe	---	---	---	---	---	---	---
Cs: Colby	VIIe	---	---	---	---	---	---	---
Dw: Dwyer	VIe	---	---	---	---	---	---	---
Gb: Glenberg	IIIe	---	29	---	39	---	2.5	---
Gn: Goshen	IIc	I	36	55	51	105	3.5	6.0
Ka: Keith	IIc	I	36	55	51	105	3.5	6.0
Km: Kim	IIe	---	27	---	35	---	2.5	---
Ko: Kim	IIIe	---	24	---	31	---	2.0	---
Kr: Kim-Razor	IVe	---	23	---	30	---	---	---
Ku: Kuma	IIc	I	36	55	51	105	4.0	6.0
Lh: Las Animas	IIIw	---	17	---	23	---	3.5	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Winter wheat		Grain sorghum		Alfalfa hay	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons
Mc----------------------- Manter	IIIe	---	27	---	38	---	3.0	---
Ot----------------------- Otero	VIe	---	---	---	---	---	---	---
Ps----------------------- Pleasant	IVw	---	22	---	29	---	---	---
Rm----------------------- Razor-Midway	VIe	---	---	---	---	---	---	---
Sb----------------------- Satanta	IIc	I	35	55	49	100	3.0	6.0
Sc----------------------- Satanta	IIe	IIe	32	50	45	90	3.0	5.0
Ua----------------------- Ulysses	IIc	I	33	55	47	100	3.5	6.0
Ub----------------------- Ulysses	IIe	IIe	32	50	45	90	3.0	5.0

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Bc-----------------	Sands------------------------	Favorable	2,500	Sand bluestem----------------	40
Bankard		Normal	1,750	Prairie sandreed-------------	5
		Unfavorable	1,000	Needleandthread--------------	5
				Switchgrass------------------	5
				Blue grama-------------------	5
				Sideoats grama---------------	5
Bg, Bh-------------	Loamy Terrace----------------	Favorable	3,500	Big bluestem-----------------	35
Bridgeport		Normal	2,500	Sideoats grama---------------	25
		Unfavorable	1,500	Western wheatgrass-----------	15
				Little bluestem--------------	10
Bs-----------------	Loamy Lowland----------------	Favorable	4,000	Big bluestem-----------------	35
Bridgeport		Normal	3,000	Sideoats grama---------------	10
		Unfavorable	2,000	Switchgrass------------------	10
				Western wheatgrass-----------	10
				Little bluestem--------------	5
Bw-----------------	Loamy Lowland----------------	Favorable	4,000	Big bluestem-----------------	35
Bridgeport		Normal	3,000	Sideoats grama---------------	25
		Unfavorable	2,000	Western wheatgrass-----------	10
				Switchgrass------------------	10
				Little bluestem--------------	5
Ca*:					
Canyon------------	Shallow Limy-----------------	Favorable	1,500	Little bluestem--------------	30
		Normal	1,400	Sideoats grama---------------	30
		Unfavorable	750	Big bluestem-----------------	10
				Blue grama-------------------	10
				Hairy grama------------------	5
				Plains muhly-----------------	5
Kim---------------	Limy Upland------------------	Favorable	2,400	Little bluestem--------------	30
		Normal	1,800	Sideoats grama---------------	20
		Unfavorable	1,400	Big bluestem-----------------	10
				Blue grama-------------------	5
				Western wheatgrass-----------	5
				Buffalograss-----------------	5
Cf-----------------	Subirrigated-----------------	Favorable	8,000	Big bluestem-----------------	30
Caruso		Normal	7,000	Switchgrass------------------	15
		Unfavorable	6,000	Prairie cordgrass------------	10
				Indiangrass------------------	5
				Western wheatgrass-----------	5
				Sedge------------------------	5
				Little bluestem--------------	5
Co, Cp-------------	Limy Upland------------------	Favorable	2,400	Little bluestem--------------	30
Colby		Normal	1,800	Sideoats grama---------------	15
		Unfavorable	1,000	Blue grama-------------------	10
				Big bluestem-----------------	10
				Western wheatgrass-----------	5
Cs-----------------	Loess Breaks-----------------	Favorable	2,400	Little bluestem--------------	50
Colby		Normal	1,800	Sideoats grama---------------	10
		Unfavorable	1,000	Blue grama-------------------	10
				Western wheatgrass-----------	10

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Dw: Dwyer	Sands	Favorable	2,200	Sand bluestem	40
		Normal	1,500	Little bluestem	15
		Unfavorable	1,000	Western wheatgrass	10
				Prairie sandreed	5
				Fringed sagebrush	5
Gb: Glenberg	Sandy Terrace	Favorable	3,000	Prairie sandreed	20
		Normal	2,500	Switchgrass	15
		Unfavorable	2,000	Sand bluestem	15
				Needlegrass	10
				Blue grama	5
				Sand dropseed	5
				Little bluestem	5
				Sideoats grama	5
				Sand sagebrush	5
				Sedge	5
Gn: Goshen	Loamy Terrace	Favorable	3,300	Big bluestem	30
		Normal	2,900	Sideoats grama	20
		Unfavorable	2,000	Western wheatgrass	10
				Little bluestem	10
				Blue grama	5
				Buffalograss	5
Ka: Keith	Loamy Upland	Favorable	2,500	Blue grama	30
		Normal	2,000	Western wheatgrass	20
		Unfavorable	1,000	Buffalograss	15
				Little bluestem	10
Km, Ko: Kim	Limy Upland	Favorable	2,000	Little bluestem	30
		Normal	1,800	Sideoats grama	25
		Unfavorable	1,400	Big bluestem	15
				Blue grama	10
				Western wheatgrass	5
Kr*:					
Kim	Limy Upland	Favorable	2,000	Little bluestem	30
		Normal	1,800	Sideoats grama	25
		Unfavorable	1,400	Big bluestem	15
				Blue grama	10
				Western wheatgrass	5
Razor	Clay Upland	Favorable	1,500	Western wheatgrass	40
		Normal	1,200	Blue grama	20
		Unfavorable	900	Green needlegrass	15
				Fourwing saltbush	5
				Winterfat	5
Ku: Kuma	Loamy Upland	Favorable	2,500	Blue grama	30
		Normal	2,000	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	20
				Buffalograss	15
				Big bluestem	10
Lh: Las Animas	Subirrigated	Favorable	8,000	Sand bluestem	30
		Normal	7,000	Switchgrass	15
		Unfavorable	6,000	Indiangrass	10
				Prairie cordgrass	10

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Mc: Manter	Sandy	Favorable	2,000	Sideoats grama	20
		Normal	1,600	Blue grama	15
		Unfavorable	1,200	Little bluestem	15
				Switchgrass	10
				Sand dropseed	10
Ot: Otero	Sandy	Favorable	2,000	Sideoats grama	20
		Normal	1,500	Blue grama	15
		Unfavorable	1,000	Little bluestem	15
				Sand dropseed	12
				Switchgrass	10
Ps: Pleasant	Clay Upland	Favorable	2,400	Western wheatgrass	50
		Normal	1,800	Buffalograss	15
		Unfavorable	1,000	Blue grama	10
				Sedge	5
Rm*:					
Razor	Clay Upland	Favorable	1,500	Western wheatgrass	40
		Normal	1,200	Blue grama	20
		Unfavorable	900	Green needlegrass	15
				Fourwing saltbush	5
				Winterfat	5
Midway	Shale Breaks	Favorable	1,100	Blue grama	25
		Normal	800	Sideoats grama	25
		Unfavorable	500	Western wheatgrass	20
				Switchgrass	5
Sb, Sc: Satanta	Loamy Upland	Favorable	2,300	Blue grama	30
		Normal	1,500	Sideoats grama	20
		Unfavorable	1,200	Western wheatgrass	20
				Little bluestem	10
				Big bluestem	10
Ua, Ub: Ulysses	Loamy Upland	Favorable	2,400	Blue grama	30
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,000	Sideoats grama	20
				Little bluestem	10
				Big bluestem	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Bc-----------------Bankard	American plum, skunkbush sumac, lilac.	Siberian peashrub, Russian olive.	Rocky Mountain juniper, eastern redcedar, honeylocust, green ash, hackberry, ponderosa pine.	Siberian elm------	---
Bg, Bh, Bs, Bw----Bridgeport	Lilac, American plum.	Common chokecherry	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, hackberry, green ash, Russian olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
Ca*: Canyon.					
Kim---------------	Siberian peashrub, fragrant sumac, silver buffaloberry, tamarisk.	Eastern redcedar, Russian olive, Rocky Mountain juniper, honeylocust, ponderosa pine, green ash, black locust.	Siberian elm------	---	---
Cf-----------------Caruso	American plum, lilac.	Common chokecherry	Russian olive, eastern redcedar, Rocky Mountain juniper, green ash, ponderosa pine, hackberry.	Honeylocust-------	Siberian elm, eastern cottonwood.
Co, Cp-------------Colby	Siberian peashrub, fragrant sumac, silver buffaloberry, tamarisk.	Eastern redcedar, Russian olive, ponderosa pine, Rocky Mountain juniper, green ash, black locust.	Siberian elm, honeylocust.	---	---
Cs. Colby					
Dw-----------------Dwyer	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine----	---	---
Gb-----------------Glenberg	Siberian peashrub	Silver buffaloberry, common chokecherry.	Ponderosa pine, Russian olive, eastern redcedar, Rocky Mountain juniper, hackberry, green ash.	Siberian elm, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Gn: Goshen	Lilac, American plum.	Common chokecherry	Eastern redcedar, green ash, hackberry, ponderosa pine, Russian olive, Rocky Mountain juniper.	Siberian elm, honeylocust.	Eastern cottonwood.
Ka: Keith	Lilac, American plum.	Manchurian crabapple, common chokecherry, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust, Russian olive, eastern redcedar.	Siberian elm	---
Km, Ko: Kim	Siberian peashrub, fragrant sumac, silver buffaloberry, tamarisk.	Eastern redcedar, Russian olive, Rocky Mountain juniper, honeylocust, ponderosa pine, green ash, black locust.	Siberian elm	---	---
Kr*:					
Kim	Siberian peashrub, fragrant sumac, silver buffaloberry, tamarisk.	Russian olive, Rocky Mountain juniper, honeylocust, ponderosa pine, green ash, black locust, eastern redcedar.	Siberian elm	---	---
Razor	Siberian peashrub, tamarisk, fragrant sumac, silver buffaloberry.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian olive, black locust, eastern redcedar.	Siberian elm, honeylocust.	---	---
Ku: Kuma	Fragrant sumac, lilac, Amur honeysuckle.	Russian olive, common chokecherry.	Eastern redcedar, green ash, ponderosa pine, honeylocust, bur oak, hackberry.	Siberian elm	---
Lh: Las Animas	Lilac, American plum.	Common chokecherry	Eastern redcedar, green ash, ponderosa pine, hackberry, Rocky Mountain juniper.	Golden willow, Siberian elm, honeylocust.	Eastern cottonwood.
Mc: Manter	Skunkbush sumac, common chokecherry, lilac, Amur honeysuckle, American plum.	Rocky Mountain juniper, Russian mulberry.	Ponderosa pine, hackberry, green ash, eastern redcedar.	Siberian elm	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ot: Otero	Lilac, American plum, common chokecherry, Amur honeysuckle.	Russian mulberry	Hackberry, green ash, eastern redcedar, Rocky Mountain juniper, ponderosa pine, honeylocust.	Siberian elm	---
Ps. Pleasant					
Rm*:					
Razor	Siberian peashrub, tamarisk, fragrant sumac, silver buffaloberry.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian olive, black locust, eastern redcedar.	Siberian elm, honeylocust.	---	---
Midway.					
Sb, Sc: Satanta	Fragrant sumac, lilac, Amur honeysuckle.	Russian olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, hackberry, bur oak.	Siberian elm	---
Ua, Ub: Ulysses	Fragrant sumac, Amur honeysuckle, lilac.	Russian olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, bur oak, hackberry.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Bc----- Bankard	Severe: flooding.	Slight-----	Moderate: flooding.	Slight.
Bg----- Bridgeport	Severe: flooding.	Slight-----	Slight-----	Slight.
Bh----- Bridgeport	Slight-----	Slight-----	Moderate: slope.	Slight.
Bs----- Bridgeport	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Bw----- Bridgeport	Severe: flooding.	Slight-----	Moderate: flooding.	Slight.
Ca*:				
Canyon-----	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: thin layer, area reclaim, slope.	Moderate: slope, dusty.
Kim-----	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Cf----- Caruso	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight.
Co----- Colby	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
Cp----- Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Cs----- Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Dw----- Dwyer	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Gb----- Glenberg	Severe: flooding.	Slight-----	Moderate: small stones.	Slight.
Gn----- Goshen	Severe: flooding.	Slight-----	Slight-----	Slight.
Ka----- Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Km, Ko: Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.
Kr*:				
Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.
Razor	Slight	Slight	Moderate: slope.	Slight.
Ku: Kuma	Slight	Slight	Slight	Slight.
Lh: Las Animas	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
Mc: Manter	Slight	Slight	Moderate: slope, small stones.	Slight.
Ot: Otero	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ps: Pleasant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Rm*:				
Razor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Sb: Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Sc: Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ua: Ulysses	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Ub: Ulysses	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor")

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
Bc----------------- Bankard	Fair	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Fair.
Bg----------------- Bridgeport	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Fair.
Bh----------------- Bridgeport	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
Bs, Bw------------- Bridgeport	Fair	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Ca*:									
Canyon------------	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
Kim---------------	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Cf----------------- Caruso	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
Co----------------- Colby	Fair	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Cp, Cs------------- Colby	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
Dw----------------- Dwyer	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Gb----------------- Glenberg	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Gn----------------- Goshen	Fair	Good	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
Ka----------------- Keith	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Km, Ko------------- Kim	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Kr*:									
Kim---------------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Razor-------------	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Ku----------------- Kuma	Good	Good	Fair	Poor	Poor	Very poor	Fair	Very poor	Poor.
Lh----------------- Las Animas	Fair	Good	Good	Good	Fair	Fair	Good	Fair	Good.
Mc----------------- Manter	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Ot: Otero	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Ps: Pleasant	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Rm*:									
Razor	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Midway	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Sb, Sc: Satanta	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Ua, Ub: Ulysses	Good	Good	Fair	Poor	Poor	Fair	Fair	Poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Bc: Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Bg: Bridgeport	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Bh: Bridgeport	Slight	Slight	Slight	Slight	Severe: low strength.
Bs, Bw: Bridgeport	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Ca*:					
Canyon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kim	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Cf: Caruso	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding.
Co: Colby	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Cp: Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Cs: Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Dw: Dwyer	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Gb: Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Gn: Goshen	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.
Ka: Keith	Slight	Slight	Slight	Moderate: shrink-swell.	Severe: low strength.
Km: Kim	Slight	Slight	Slight	Slight	Slight.
Ko: Kim	Slight	Slight	Slight	Moderate: slope.	Slight.
Kr*:					
Kim	Slight	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Kr*:					
Razor	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ku Kuma	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
Lh Las Animas	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
Mc Manter	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
Ot Otero	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Ps Pleasant	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
Rm*:					
Razor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Sb, Sc Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.
Ua, Ub Ulysses	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Bc------------------ Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
Bg------------------ Bridgeport	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Bh------------------ Bridgeport	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Bs, Bw-------------- Bridgeport	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Ca*:					
Canyon-------------	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, small stones, slope.
Kim----------------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Cf------------------ Caruso	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Co------------------ Colby	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
Cp------------------ Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Cs------------------ Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Dw------------------ Dwyer	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy.
Gb------------------ Glenberg	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
Gn------------------ Goshen	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Ka------------------ Keith	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Km, Ko-------------- Kim	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: small stones.
Kr*:					
Kim----------------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: small stones.
Razor--------------	Severe: thin layer, percs slowly.	Severe: seepage.	Severe: seepage, excess salt.	Moderate: seepage.	Poor: area reclaim, hard to pack.
Ku----------------- Kuma	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Lh----------------- Las Animas	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: too sandy, wetness, thin layer.
Mc----------------- Manter	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Ot----------------- Otero	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Ps----------------- Pleasant	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Rm*:					
Razor--------------	Severe: thin layer, percs slowly.	Severe: seepage, slope.	Severe: seepage, excess salt.	Moderate: seepage, slope.	Poor: area reclaim, hard to pack.
Midway-------------	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim.
Sb----------------- Satanta	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
Sc----------------- Satanta	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
Ua----------------- Ulysses	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
Ub----------------- Ulysses	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Bc: Bankard	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
Bg, Bh, Bs, Bw: Bridgeport	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ca*:				
Canyon	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Cf: Caruso	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Co: Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cp: Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Cs: Colby	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Dw: Dwyer	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Gb: Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Gn: Goshen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ka: Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Km, Ko: Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Kr*:				
Kim	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Razor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.
Ku: Kuma	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Lh: Las Animas	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones.
Mc: Manter	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ot: Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Ps: Pleasant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Rm*:				
Razor	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey, small stones.
Midway	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.
Sb, Sc: Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Ua, Ub: Ulysses	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate" and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Bc: Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
Bg: Bridgeport	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Bh: Bridgeport	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Bs, Bw: Bridgeport	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Ca*:						
Canyon	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Kim	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Too arid, slope.
Cf: Caruso	Moderate: seepage.	Severe: piping.	Flooding	Wetness, flooding.	Wetness	Favorable.
Co: Colby	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Cp, Cs: Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Dw: Dwyer	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
Gb: Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty	Too sandy, soil blowing.	Droughty.
Gn: Goshen	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ka: Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Km: Kim	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Too arid.
Ko: Kim	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Too arid.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Kr*:						
Kim	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Too arid.
Razor	Moderate: depth to rock, slope.	Severe: excess salt.	Deep to water	Percs slowly, thin layer.	Area reclaim, percs slowly.	Area reclaim, percs slowly.
Ku Kuma	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Lh Las Animas	Severe: seepage.	Severe: piping, wetness.	Flooding, cutbanks cave.	Wetness, soil blowing, flooding.	Wetness, soil blowing.	Favorable.
Mc Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
Ot Otero	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.
Ps Pleasant	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
Rm*:						
Razor	Severe: slope.	Severe: excess salt.	Deep to water	Percs slowly, thin layer.	Slope, area reclaim, percs slowly.	Slope, area reclaim, percs slowly.
Midway	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Slope, percs slowly.	Slope, area reclaim, erodes easily.	Too arid, slope, erodes easily.
Sb, Sc Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Ua, Ub Ulysses	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Bc-------------- Bankard	0-6	Loamy fine sand	SM	A-2	0	95-100	90-100	50-90	15-35	---	NP
	6-60	Stratified loamy fine sand to sand.	SM, SP-SM	A-2	0	95-100	75-100	60-80	10-25	---	NP
Bg-------------- Bridgeport	0-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	4-19
	12-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	90-100	65-100	25-40	8-20
Bh, Bs, Bw------- Bridgeport	0-16	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	65-90	20-35	4-19
	16-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	90-100	65-100	25-40	8-20
Ca*:											
Canyon----------	0-5	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	5-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Kim-------------	0-6	Loam-------------	ML, CL-ML, SM-SC, SM	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	6-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
Cf-------------- Caruso	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	70-95	35-45	11-20
	10-60	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	95-100	65-85	25-45	5-20
Co-------------- Colby	0-5	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	5-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Cp-------------- Colby	0-5	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	5-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Cs-------------- Colby	0-5	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	5-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Dw-------------- Dwyer	0-8	Loamy fine sand	SM	A-2	0	100	100	65-80	20-35	---	NP
	8-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-3, A-2	0	85-100	75-100	50-80	5-35	---	NP
Gb-------------- Glenberg	0-8	Fine sandy loam	SM	A-4, A-2	0	95-100	85-100	60-100	30-45	---	NP
	8-60	Stratified loamy sand to clay loam.	SM	A-2, A-4	0	90-100	75-100	50-100	25-40	---	NP
Gn-------------- Goshen	0-16	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	70-95	20-40	3-20
	16-42	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	85-95	25-40	8-22
	42-60	Silt loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-35	4-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ka---------------- Keith	0-10	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	10-24	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	24-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Km, Ko----------- Kim	0-6	Loam-------------	ML, CL-ML, SM-SC, SM	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	6-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
Kr*:											
Kim-------------	0-6	Loam-------------	ML, CL-ML, SM-SC, SM	A-4	0-5	80-100	75-100	60-90	55-75	20-30	NP-10
	6-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	50-95	35-85	20-40	5-15
Razor-----------	0-4	Silty clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	4-18	Silty clay, silty clay loam, clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	18-32	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	32-36	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ku---------------- Kuma	0-5	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	95-100	75-95	25-40	NP-15
	5-29	Silty clay loam, silt loam, loam.	CL	A-6, A-7, A-4	0	100	95-100	95-100	85-95	30-45	10-25
	29-60	Silty clay loam, very fine sandy loam, silt loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	75-95	20-40	NP-15
Lh---------------- Las Animas	0-6	Loam-------------	CL, ML	A-4	0	100	95-100	80-95	60-90	25-30	5-10
	6-32	Stratified clay loam to loamy fine sand.	SM, ML	A-2, A-4	0	95-100	90-100	55-90	25-55	20-25	NP-5
	32-60	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	95-100	75-100	5-25	---	NP
Mc---------------- Manter	0-10	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	95-100	75-100	45-85	25-55	20-30	NP-10
	10-24	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-10
	24-60	Sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
Ot---------------- Otero	0-8	Fine sandy loam	SM	A-2	0-1	95-100	75-100	50-80	25-35	20-25	NP-5
	8-60	Sandy loam, fine sandy loam, loamy very fine sand.	SM	A-2	0-1	90-100	75-100	40-80	25-35	15-25	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ps---------------- Pleasant	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	15-25
	8-32	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	100	100	95-100	95-100	40-65	20-45
	32-60	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	95-100	80-100	25-40	NP-15
Rm*:											
Razor-----------	0-4	Silty clay loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	75-95	30-50	15-30
	4-18	Silty clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0	100	100	90-100	80-100	35-60	20-45
	18-32	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	32-36	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway----------	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-12	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	12-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sb, Sc----------- Satanta	0-10	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	10-32	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	32-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Ua, Ub----------- Ulysses	0-12	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	12-22	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-100	25-43	11-20
	22-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Bc---------------- Bankard	0-6	2-10	1.80-1.95	6.0-20	0.10-0.15	7.4-8.4	<2	Low--------	0.17	5	2	.5-1
	6-60	0-10	1.85-2.00	6.0-20	0.07-0.15	7.4-9.0	<2	Low--------	0.17			
Bg---------------- Bridgeport	0-12	14-27	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.32	5	4L	1-4
	12-60	18-30	1.35-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43			
Bh---------------- Bridgeport	0-16	14-27	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.32	5	4L	1-4
	16-60	18-30	1.35-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43			
Bs, Bw----------- Bridgeport	0-16	14-27	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.32	5	4L	1-4
	16-60	18-30	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Ca*:												
Canyon-----------	0-5	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	5-14	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	14-60	---	---	---	---	---	---	-----------	----			
Kim--------------	0-6	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.32	5	4L	.5-1
	6-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low--------	0.32			
Cf---------------- Caruso	0-10	27-35	1.35-1.45	0.6-2.0	0.17-0.23	7.4-8.4	<4	Moderate	0.28	5	4L	1-4
	10-60	18-35	1.35-1.50	0.6-2.0	0.16-0.22	7.4-8.4	<4	Low--------	0.28			
Co, Cp, Cs-------- Colby	0-5	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	.5-2
	5-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Dw---------------- Dwyer	0-8	3-8	1.35-1.45	6.0-20	0.08-0.11	6.1-9.0	<2	Low--------	0.17	5	2	1-3
	8-60	1-8	1.45-1.55	6.0-20	0.04-0.11	7.9-9.0	<2	Low--------	0.17			
Gb---------------- Glenberg	0-8	10-20	1.45-1.50	2.0-6.0	0.09-0.13	7.4-8.4	<2	Low--------	0.24	5	3	.5-1
	8-60	8-18	1.45-1.50	2.0-6.0	0.07-0.12	7.4-9.0	<2	Low--------	0.24			
Gn---------------- Goshen	0-16	16-25	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	16-42	25-35	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43			
	42-60	15-27	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Ka---------------- Keith	0-10	15-27	1.20-1.30	0.6-2.0	0.20-0.23	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	10-24	2-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.28			
	24-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43			
Km, Ko------------ Kim	0-6	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.32	5	4L	.5-1
	6-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low--------	0.32			
Kr*:												
Kim--------------	0-6	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.32	5	4L	.5-1
	6-60	20-35	1.40-1.50	0.6-2.0	0.15-0.17	7.9-8.4	<4	Low--------	0.32			
Razor------------	0-4	28-40	1.35-1.40	0.06-0.2	0.15-0.18	6.6-8.4	<2	High-------	0.32	4	4L	.5-2
	4-18	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High-------	0.28			
	18-32	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	>8	High-------	0.28			
	32-36	---	---	---	---	---	---	-----------	----			
Ku---------------- Kuma	0-5	15-27	1.20-1.30	0.6-2.0	0.18-0.21	6.1-8.4	<2	Low--------	0.32	5	6	2-4
	5-29	18-35	1.25-1.35	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	0.37			
	29-60	10-30	1.40-1.50	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low--------	0.32			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Lh--------------- Las Animas	0-6	8-18	1.40-1.55	0.6-2.0	0.16-0.20	7.4-8.4	<4	Low-------	0.28	5	4L	.5-2
	6-32	8-18	1.50-1.70	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low-------	0.28			
	32-60	0-5	1.50-1.60	6.0-20	0.06-0.08	7.4-8.4	<2	Low-------	0.15			
Mc--------------- Manter	0-10	10-20	1.35-1.40	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low-------	0.20	5	3	2-4
	10-24	9-18	1.40-1.50	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low-------	0.20			
	24-60	5-15	1.45-1.60	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low-------	0.20			
Ot--------------- Otero	0-8	10-20	1.40-1.45	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low-------	0.20	5	3	.5-2
	8-60	5-18	1.45-1.50	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low-------	0.17			
Ps--------------- Pleasant	0-8	27-40	1.10-1.30	0.2-0.6	0.19-0.21	6.6-7.3	<2	Moderate	0.37	4	7	2-5
	8-32	35-45	1.10-1.30	<0.06	0.14-0.18	6.6-7.8	<2	High------	0.37			
	32-60	20-32	1.10-1.30	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low-------	0.24			
Rm*:												
Razor-----------	0-4	28-40	1.35-1.40	0.06-0.2	0.15-0.18	6.6-8.4	<2	High------	0.32	4	4L	.5-2
	4-18	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	<2	High------	0.28			
	18-32	35-60	1.30-1.40	0.06-0.2	0.15-0.18	7.4-8.4	>8	High------	0.28			
	32-36	---	---	---	---	---	---	----------	----			
Midway----------	0-4	30-40	1.25-1.35	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	2	4L	.5-2
	4-12	35-45	1.20-1.35	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High------	0.43			
	12-20	---	---	---	---	---	---	----------	----			
Sb, Sc----------- Satanta	0-10	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-------	0.28	5	6	1-2
	10-32	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	32-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low-------	0.28			
Ua, Ub----------- Ulysses	0-12	10-27	1.15-1.25	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-------	0.32	5	6	1-3
	12-22	21-32	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate	0.43			
	22-60	18-27	1.25-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low-------	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Bc---------------- Bankard	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low------	Moderate	Low.
Bg---------------- Bridgeport	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Bh---------------- Bridgeport	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Bs---------------- Bridgeport	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low------	Low.
Bw---------------- Bridgeport	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low------	Low.
Ca*:												
Canyon------------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
Kim--------------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Cf---------------- Caruso	C	Occasional	Very brief	Apr-Sep	2.0-3.0	Apparent	Mar-Jun	>60	---	Moderate	High-----	Moderate.
Co, Cp, Cs-------- Colby	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Dw---------------- Dwyer	A	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Gb---------------- Glenberg	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Gn---------------- Goshen	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Ka---------------- Keith	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Km, Ko------------ Kim	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Kr*:												
Kim	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
Ku Kuma	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Lh Las Animas	C	Occasional	Brief	Mar-Aug	1.5-3.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
Mc Manter	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Ot Otero	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Ps Pleasant	D	None	---	---	+2-0	Perched	Apr-Sep	>60	---	Low	High	Low.
Rm*:												
Razor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
Midway	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Sb, Sc Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Ua, Ub Ulysses	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--ENGINEERING INDEX TEST DATA

(LL means liquid limit; PI, plasticity index; MD, maximum dry density; and OM, optimum moisture)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution*							LL	PI	Moisture density	
			Percentage passing sieve--				Percentage smaller than--					MD	OM
	AASHTO	Unified	No. 4	No. 10	No. 40	No. 200	.02 mm	.005 mm	.002 mm				
										Pct		Lb/ft3	Pct
Kim loam:													
(S85KS-023-002)													
A------ 0 to 6	A-4	SC	100	100	84	41	15	4	1	24	7	117	11
AC----- 6 to 16	A-4	SC	100	100	90	46	20	7	2	26	9	113	12
C------ 16 to 60	A-4	SC	100	100	81	37	22	11	6	24	8	118	11
Kuma silt loam:													
(S79KS-023-001)													
Ap----- 0 to 5	A-4	ML	100	100	99	90	41	15	8	36	10	94	20
Bt----- 15 to 29	A-7	CL	100	100	100	95	51	23	14	41	18	98	21
C------ 50 to 60	A-4	CL-ML	100	100	100	92	36	13	7	28	6	102	16
Razor silty clay loam:													
(S85KS-023-003)													
A------ 0 to 4	A-4	CL	100	100	98	91	36	15	6	32	10	102	18
Bw2---- 9 to 18	A-7	CL	100	100	98	93	67	42	26	44	21	100	21
C------ 26 to 32	A-7	CL	100	100	98	93	73	49	36	45	23	103	21
Satanta loam:													
(S85KS-023-004)													
A------ 0 to 10	A-4	SM-SC	100	100	88	49	20	6	2	25	6	111	14
Bt----- 16 to 23	A-6	CL	100	100	88	52	28	12	7	31	12	111	14
C------ 32 to 60	A-2	SM-SC	100	100	77	34	16	6	2	21	6	120	12

* The results obtained by engineering analysis may differ from those obtained by USDA analysis of texture because different procedures were used.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Bridgeport	Fine-silty, mixed, mesic Fluventic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Caruso	Fine-loamy, mixed, mesic Fluvaquentic Haplustolls
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Dwyer	Mixed, mesic Ustic Torripsamments
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Goshen	Fine-silty, mixed, mesic Pachic Argiustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Kim	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Kuma	Fine-silty, mixed, mesic Pachic Argiustolls
Las Animas	Coarse-loamy, mixed (calcareous), mesic Typic Fluvaquents
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Otero	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Pleasant	Fine, montmorillonitic, mesic Torrertic Argiustolls
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Ulysses	Fine-silty, mixed, mesic Aridic Haplustolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol	Map unit	Land capability* N	Land capability* I	Prime farmland*	Range site
Bc	Bankard loamy fine sand, occasionally flooded	VIw	---	No	Sands.
Bg	Bridgeport silt loam, 0 to 2 percent slopes	IIc	I	No	Loamy Terrace.
Bh	Bridgeport silt loam, 2 to 5 percent slopes	IIIe	IIIe	No	Loamy Terrace.
Bs	Bridgeport silt loam, channeled	Vw	---	No	Loamy Lowland.
Bw	Bridgeport silt loam, occasionally flooded	IIw	---	No	Loamy Lowland.
Ca	Canyon-Kim loams, 5 to 30 percent slopes	VIs	---	No	
	Canyon				Shallow Limy.
	Kim				Limy Upland.
Cf	Caruso silty clay loam, occasionally flooded	IIw	---	No	Subirrigated.
Co	Colby silt loam, 3 to 6 percent slopes	IVe	---	No	Limy Upland.
Cp	Colby silt loam, 6 to 20 percent slopes	VIe	---	No	Limy Upland.
Cs	Colby silt loam, 20 to 50 percent slopes	VIIe	---	No	Loess Breaks.
Dw	Dwyer loamy fine sand, rolling	VIe	---	No	Sands.
Gb	Glenberg fine sandy loam	IIIe	---	No	Sandy Terrace.
Gn	Goshen silt loam	IIc	I	Yes**	Loamy Terrace.
Ka	Keith silt loam, 0 to 1 percent slopes	IIc	I	Yes**	Loamy Upland.
Km	Kim loam, 1 to 3 percent slopes	IIe	---	No	Limy Upland.
Ko	Kím loam, 3 to 6 percent slopes	IIIe	---	No	Limy Upland.
Kr	Kim-Razor complex, 3 to 6 percent slopes	IVe	---	No	
	Kim				Limy Upland.
	Razor				Clay Upland.
Ku	Kuma silt loam, 0 to 1 percent slopes	IIc	I	Yes**	Loamy Upland.
Lh	Las Animas loam, occasionally flooded	IIIw	---	No	Subirrigated.
Mc	Manter fine sandy loam, 2 to 5 percent slopes	IIIe	---	No	Sandy.
Ot	Otero fine sandy loam, 5 to 15 percent slopes	VIe	---	No	Sandy.
Ps	Pleasant silty clay loam	IVw	---	No	Clay Upland.
Rm	Razor-Midway silty clay loams, 5 to 20 percent slopes	VIe	---	No	
	Razor				Clay Upland.
	Midway				Shale Breaks.
Sb	Satanta loam, 0 to 1 percent slopes	IIc	I	Yes**	Loamy Upland.
Sc	Satanta loam, 1 to 3 percent slopes	IIe	IIe	Yes**	Loamy Upland.
Ua	Ulysses silt loam, 0 to 1 percent slopes	IIc	I	Yes**	Loamy Upland.
Ub	Ulysses silt loam, 1 to 3 percent slopes	IIe	IIe	Yes**	Loamy Upland.

* A soil complex is treated as a single management unit in the land capability and prime farmland columns. The N column is for nonirrigated soils; the I column is for irrigated soils.

** Where irrigated.

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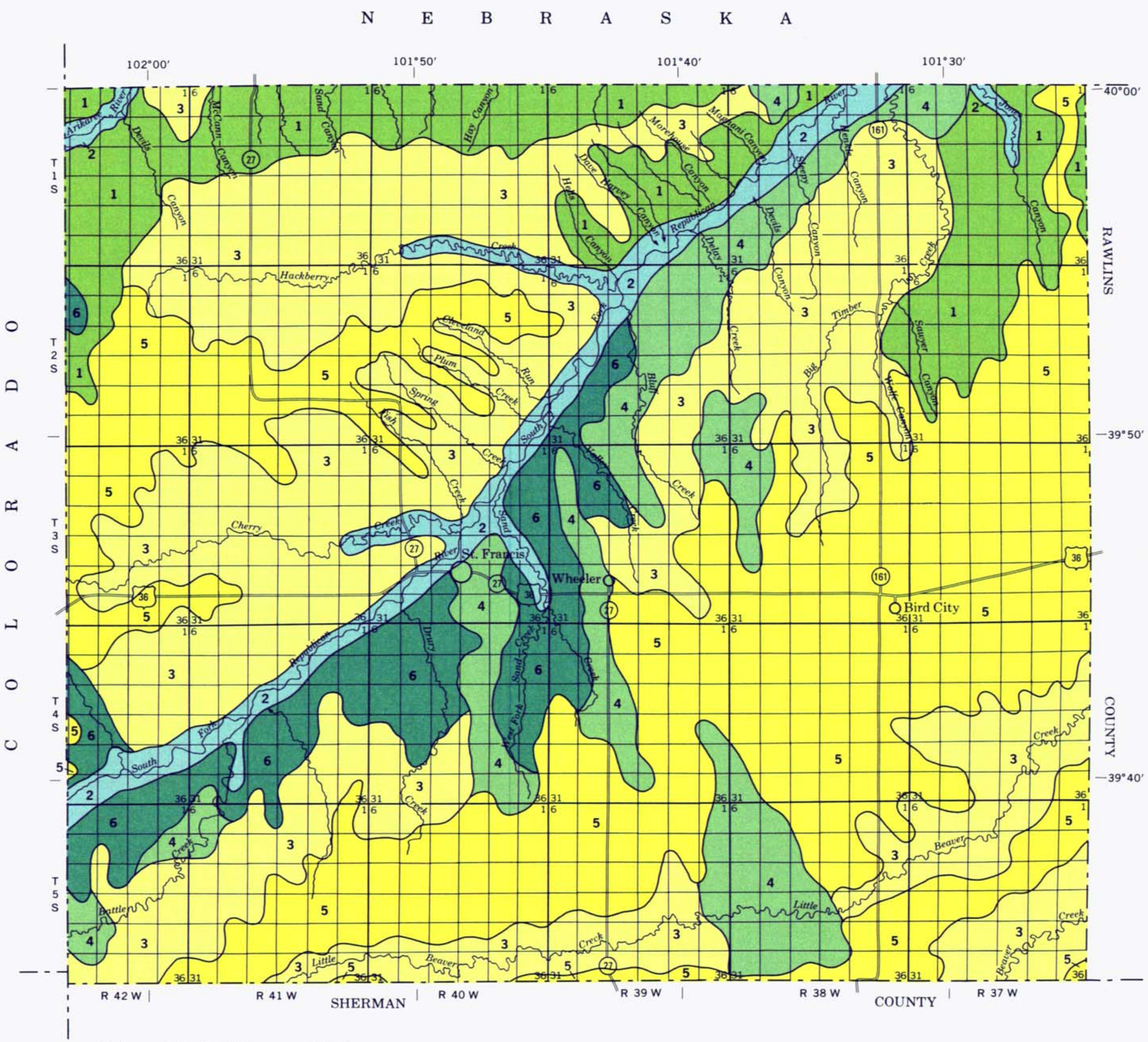


Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

LEGEND

1 — COLBY-RAZOR ASSOCIATION: Deep and moderately deep, moderately sloping to very steep, well drained soils that have a silty or clayey subsoil; on uplands

2 — BRIDGEPORT-BANKARD-GLENBERG ASSOCIATION: Deep, nearly level to moderately sloping, well drained and somewhat excessively drained soils that have a silty or loamy subsoil or that are sandy throughout; on stream terraces and flood plains

3 — COLBY-ULYSSES-KEITH ASSOCIATION: Deep, nearly level to moderately steep, well drained soils that have a silty subsoil; on uplands

4 — MANTER-SATANTA-KIM ASSOCIATION: Deep, nearly level to moderately sloping, well drained soils that have a loamy subsoil; on uplands

5 — KUMA-KEITH-ULYSSES ASSOCIATION: Deep, nearly level and gently sloping, well drained soils that have a silty subsoil; on uplands

6 — OTERO-DWYER-CANYON ASSOCIATION: Deep and shallow, moderately sloping to steep, well drained to excessively drained soils that have a loamy subsoil or that are sandy throughout; on uplands

COMPILED 1988

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
KANSAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

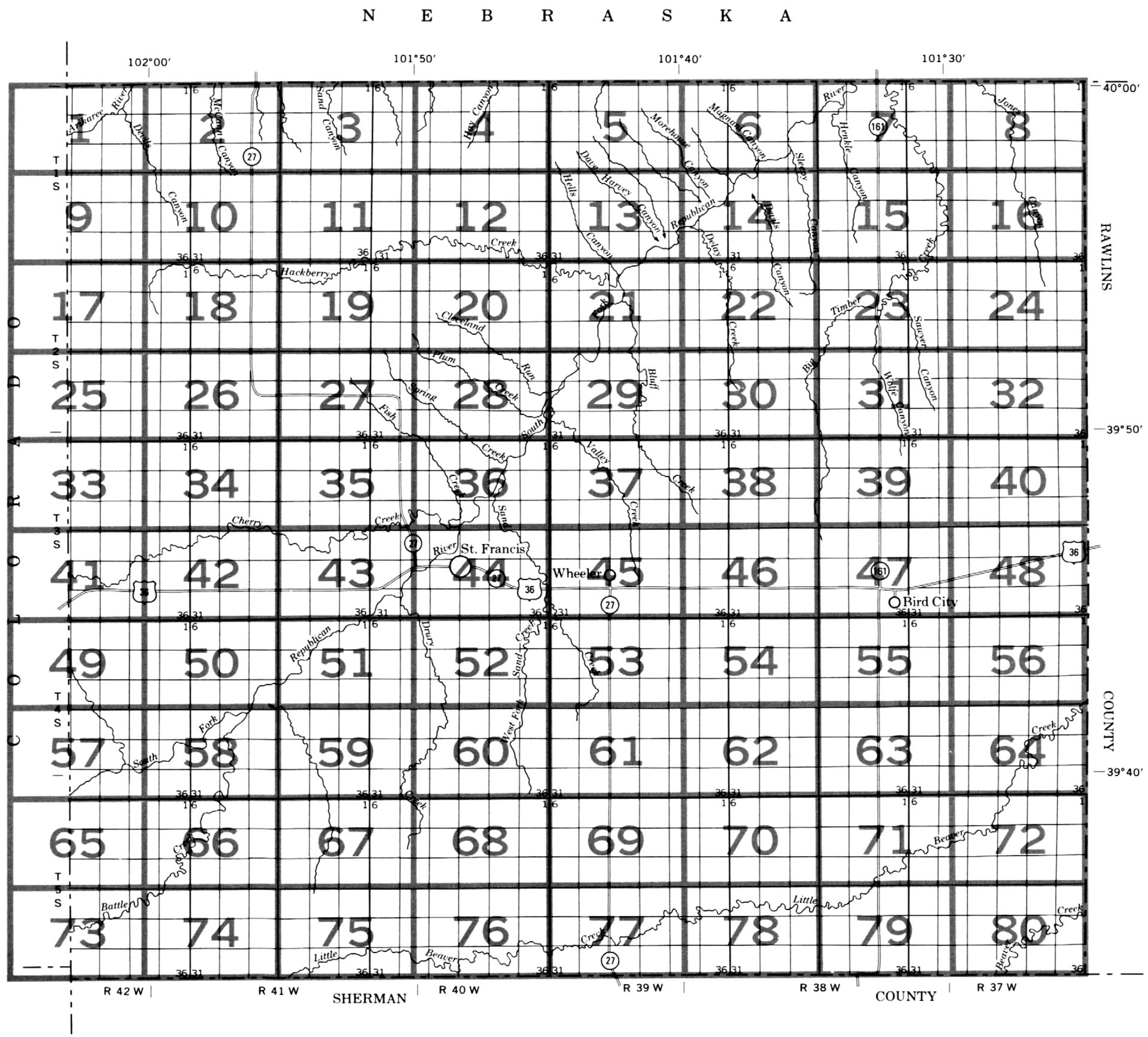
CHEYENNE COUNTY, KANSAS

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

Original text from each individual map sheet read:
This soil survey map is compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

CHEYENNE COUNTY, KANSAS

Scale 1:253,440

1 0 1 2 3 4 Mi

1 0 4 8 Km

SOIL LEGEND

SYMBOL	NAME
Bc	Bankard loamy fine sand, occasionally flooded
Bg	Bridgeport silt loam, 0 to 2 percent slopes
Bh	Bridgeport silt loam, 2 to 5 percent slopes
Bs	Bridgeport silt loam, channeled
Bw	Bridgeport silt loam, occasionally flooded
Ca	Canyon-Kim loams, 5 to 30 percent slopes
Cf	Caruso silty clay loam, occasionally flooded
Co	Colby silt loam, 3 to 6 percent slopes
Cp	Colby silt loam, 6 to 20 percent slopes
Cs	Colby silt loam, 20 to 50 percent slopes
Dw	Dwyer loamy fine sand, rolling
Gb	Glenberg fine sandy loam
Gn	Goshen silt loam
Ka	Keith silt loam, 0 to 1 percent slopes
Km	Kim loam, 1 to 3 percent slopes
Ko	Kim loam, 3 to 6 percent slopes
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Sb	Satanta loam, 0 to 1 percent slopes
Sc	Satanta loam, 1 to 3 percent slopes
Ua	Ulysses silt loam, 0 to 1 percent slopes
Ub	Ulysses silt loam, 1 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Swift Airport; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water; w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — Ca Kr

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

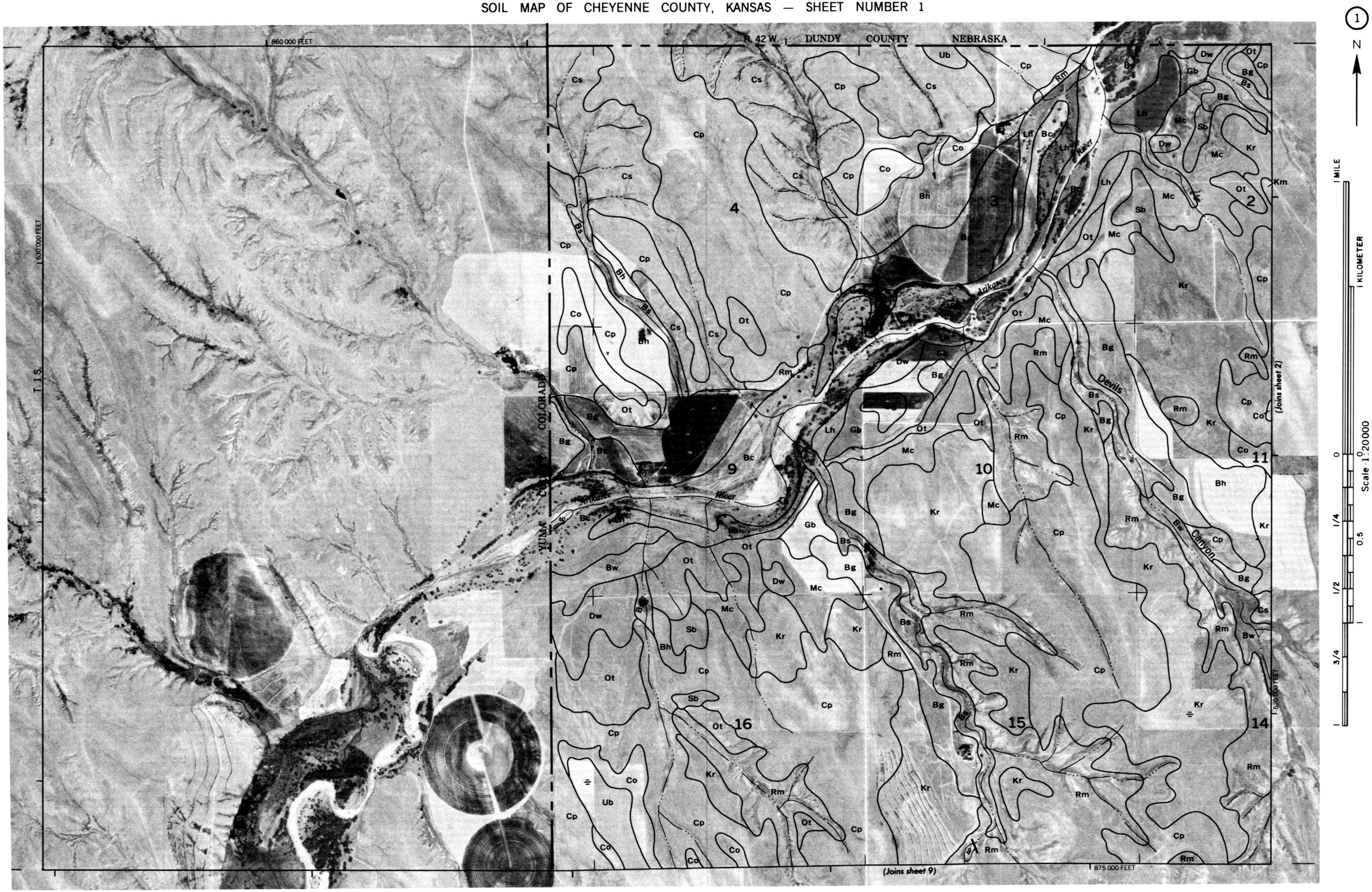
DEPRESSION OR SINK

SOIL SAMPLE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Borrow area

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 1



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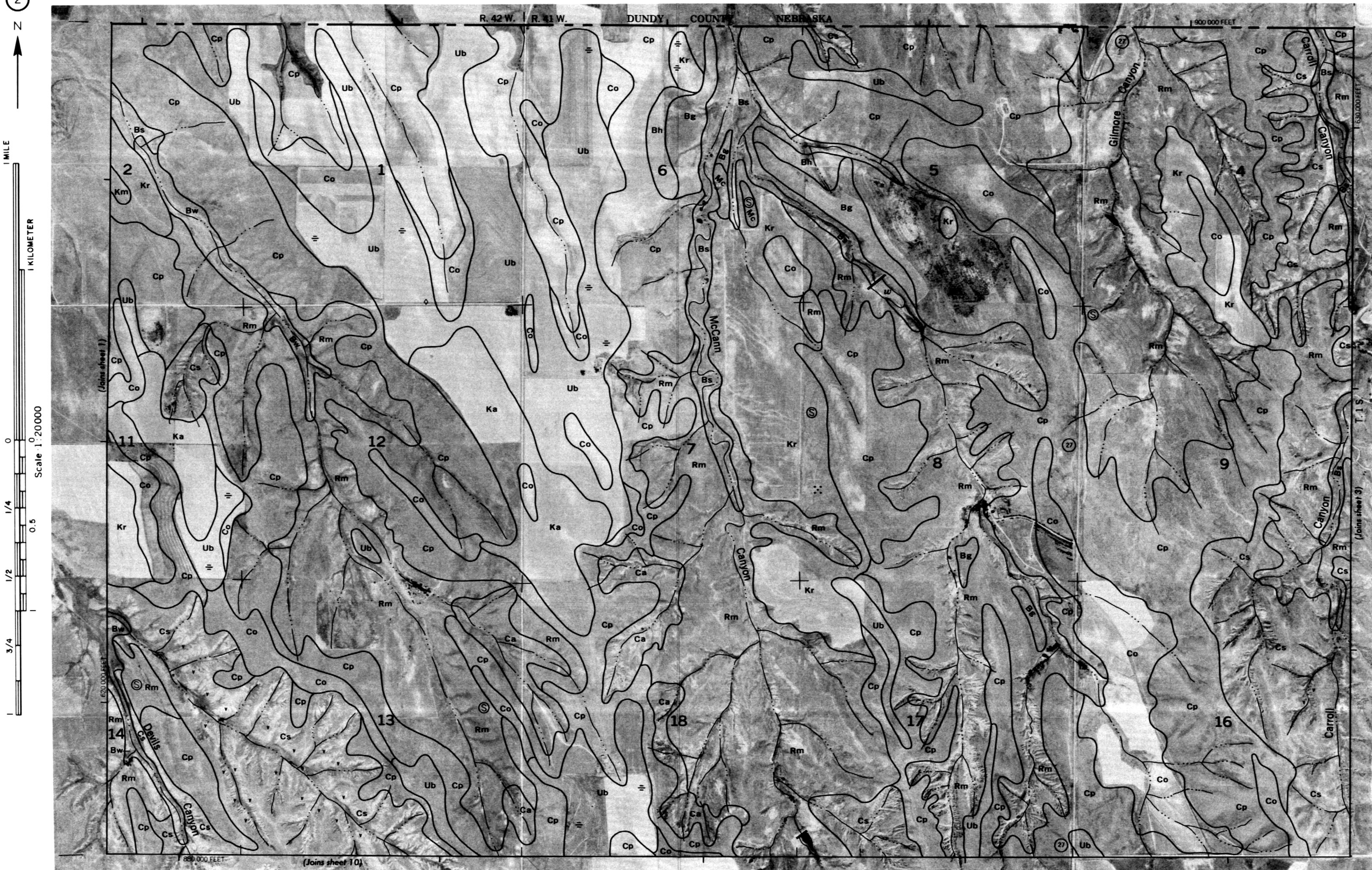
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 2



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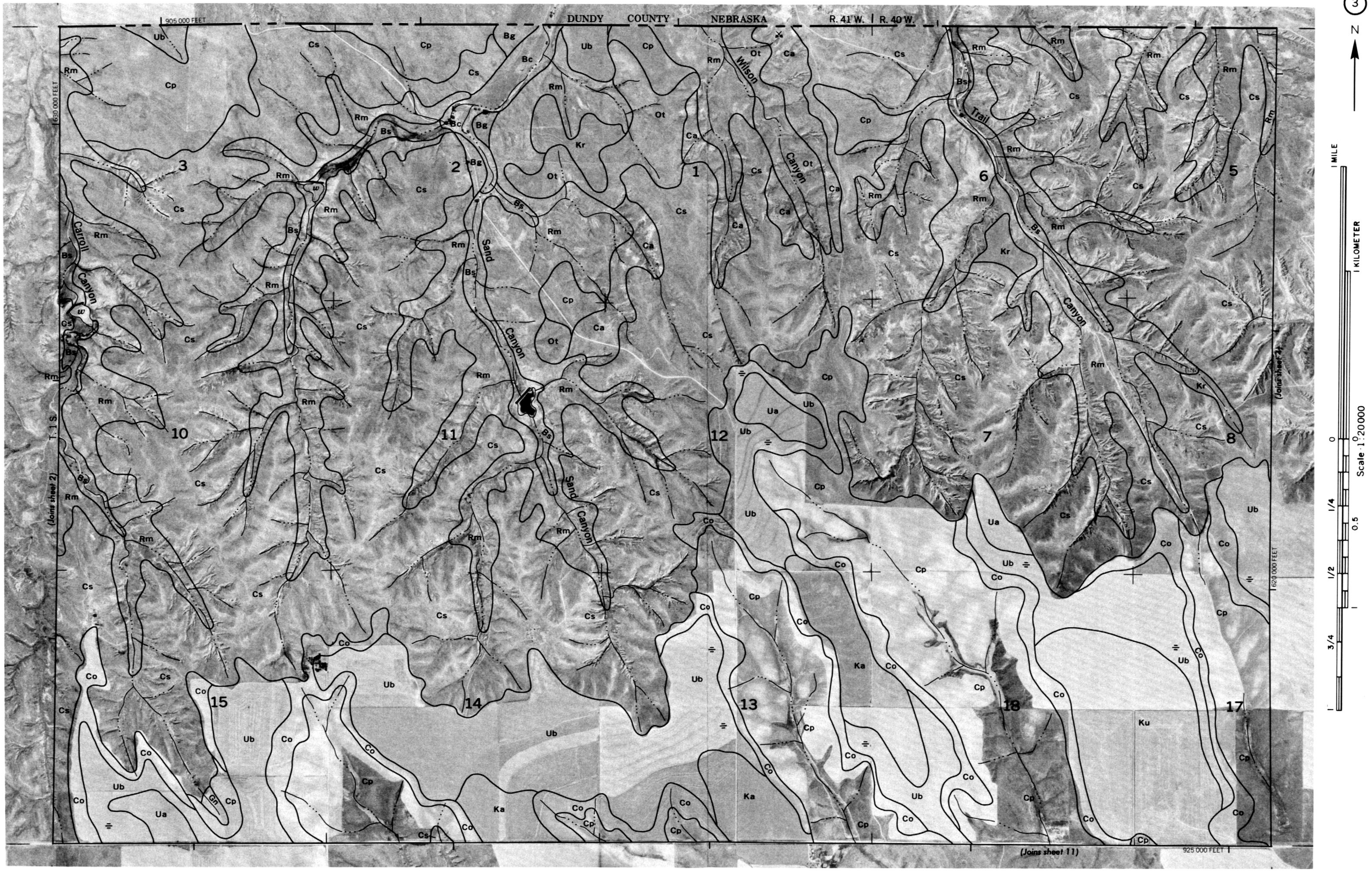

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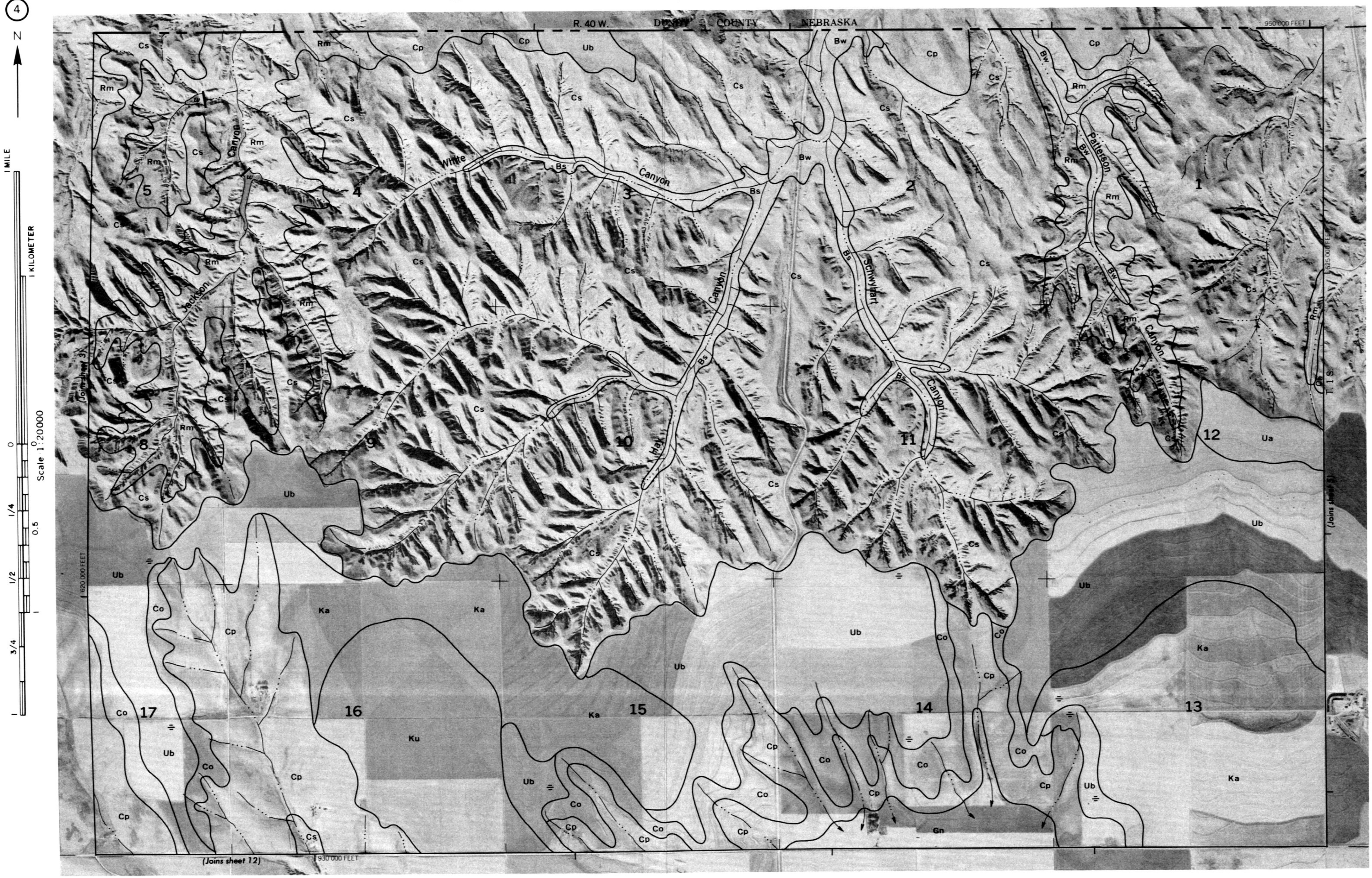

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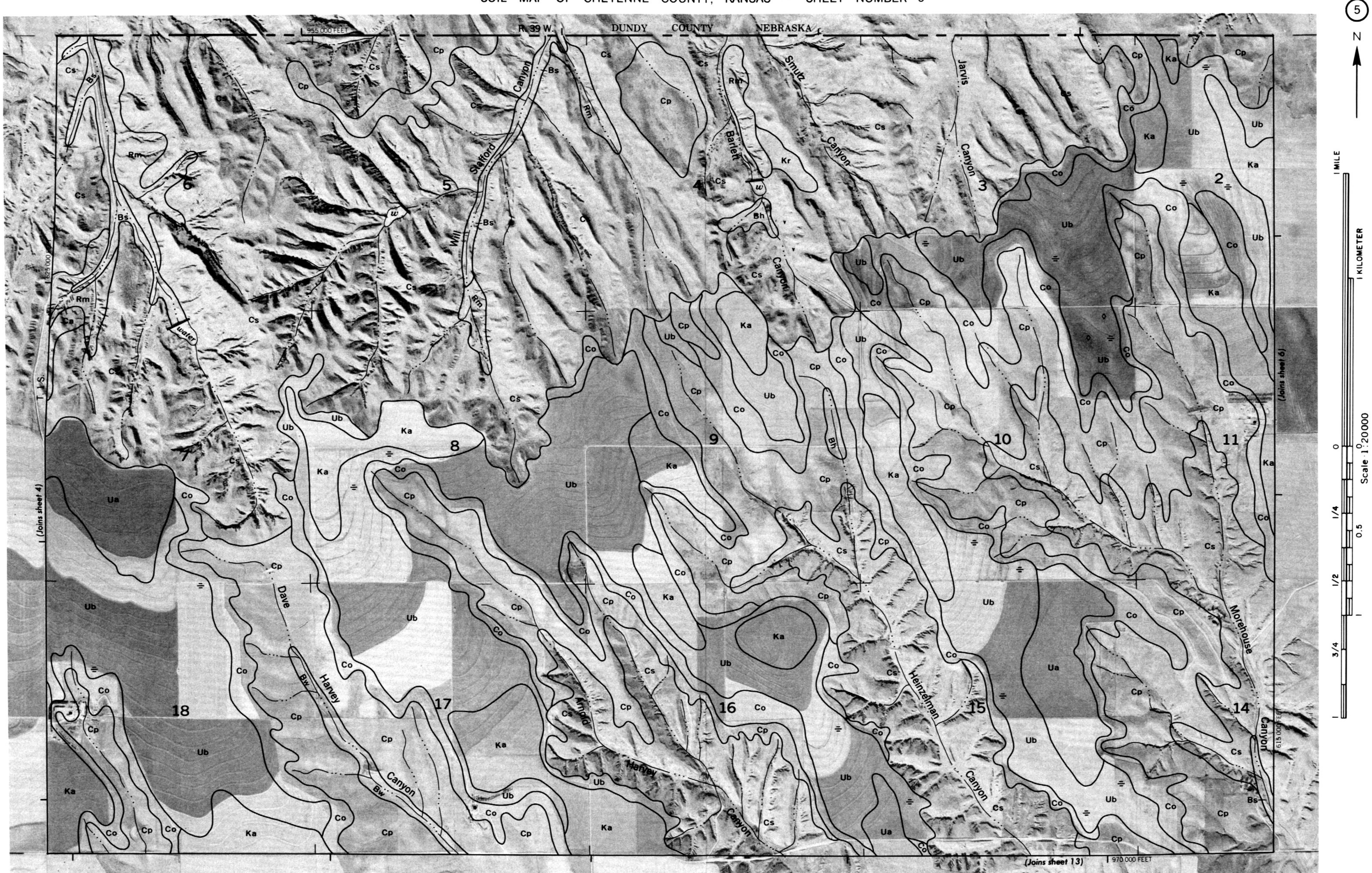

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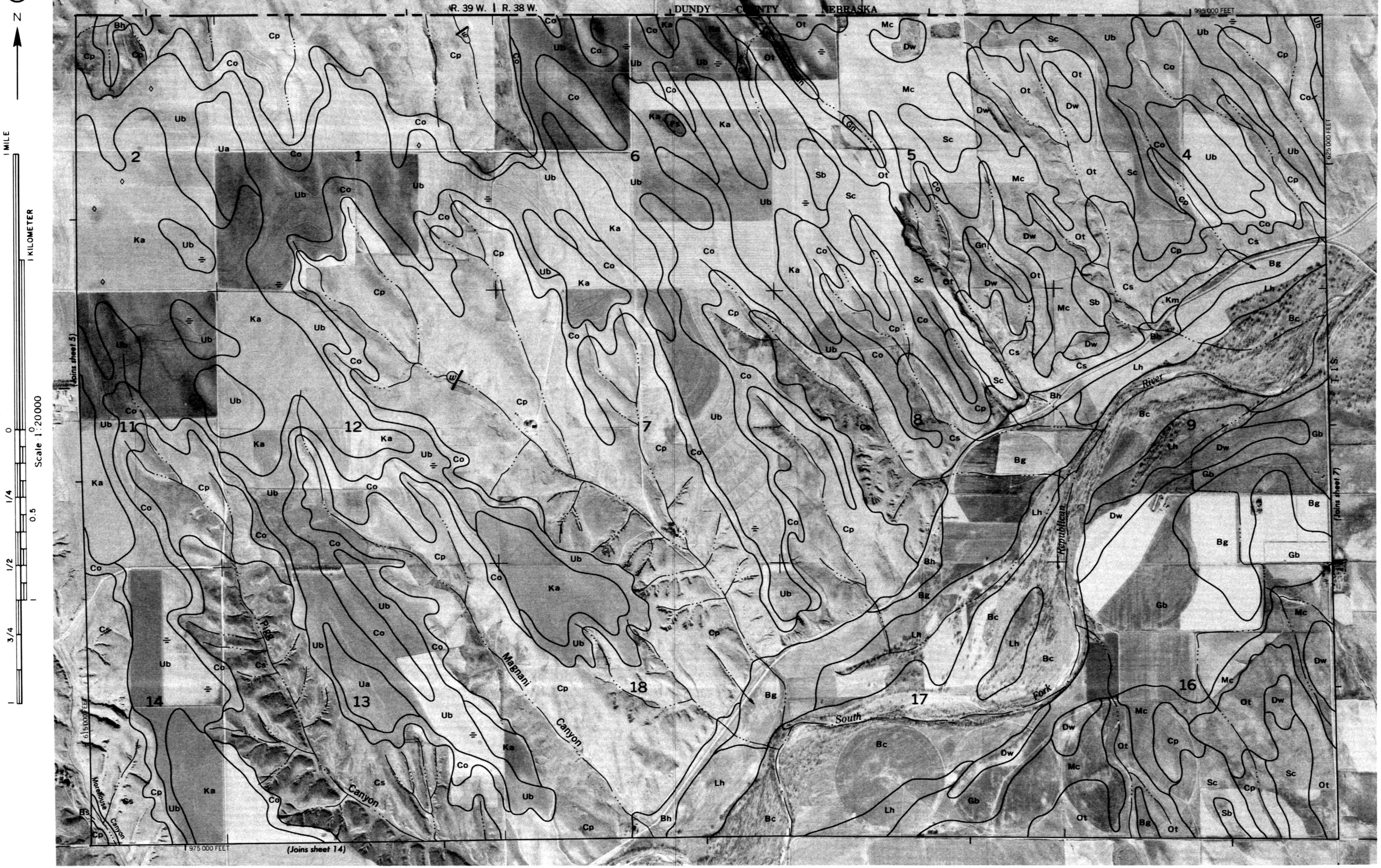

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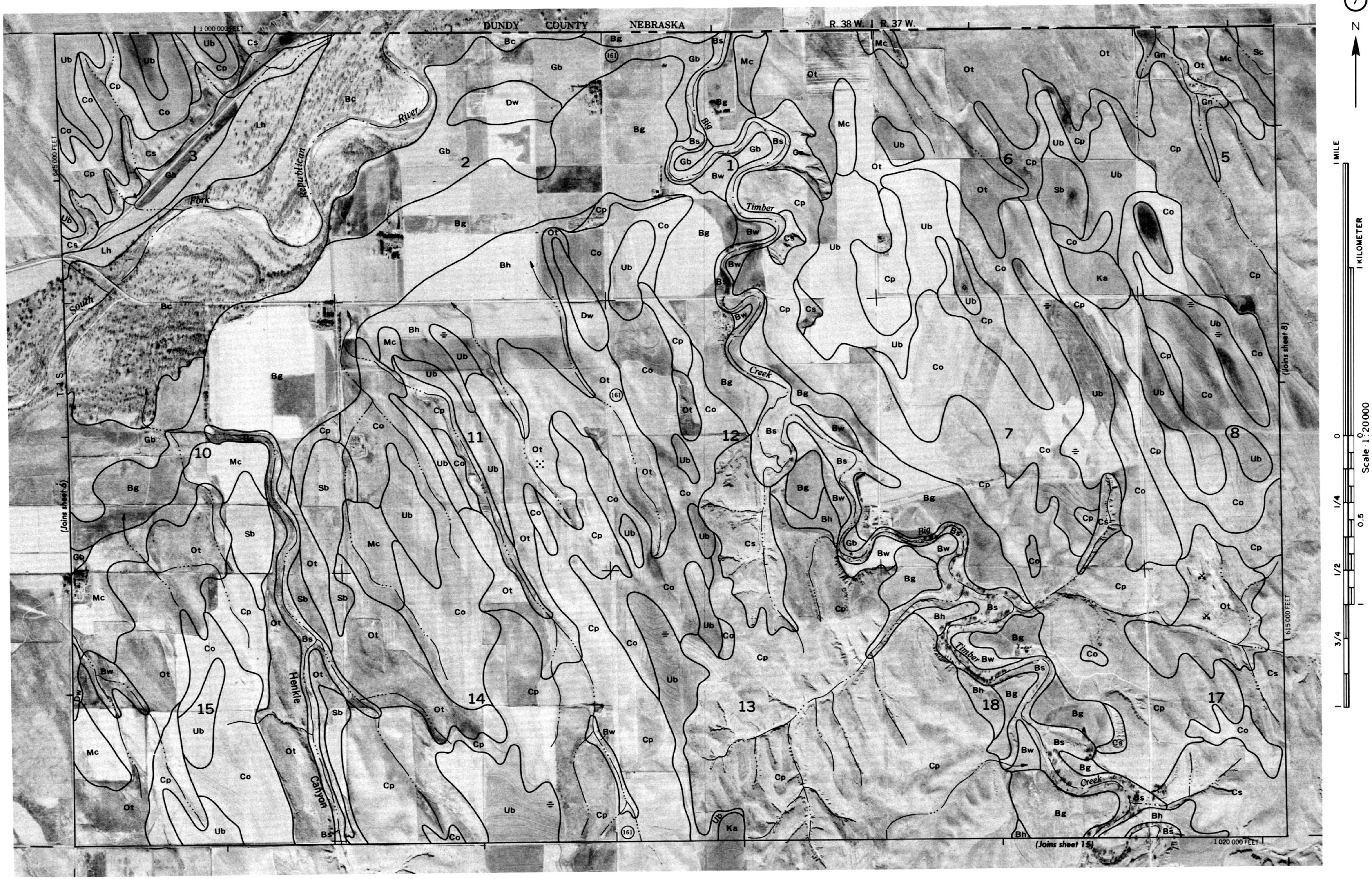

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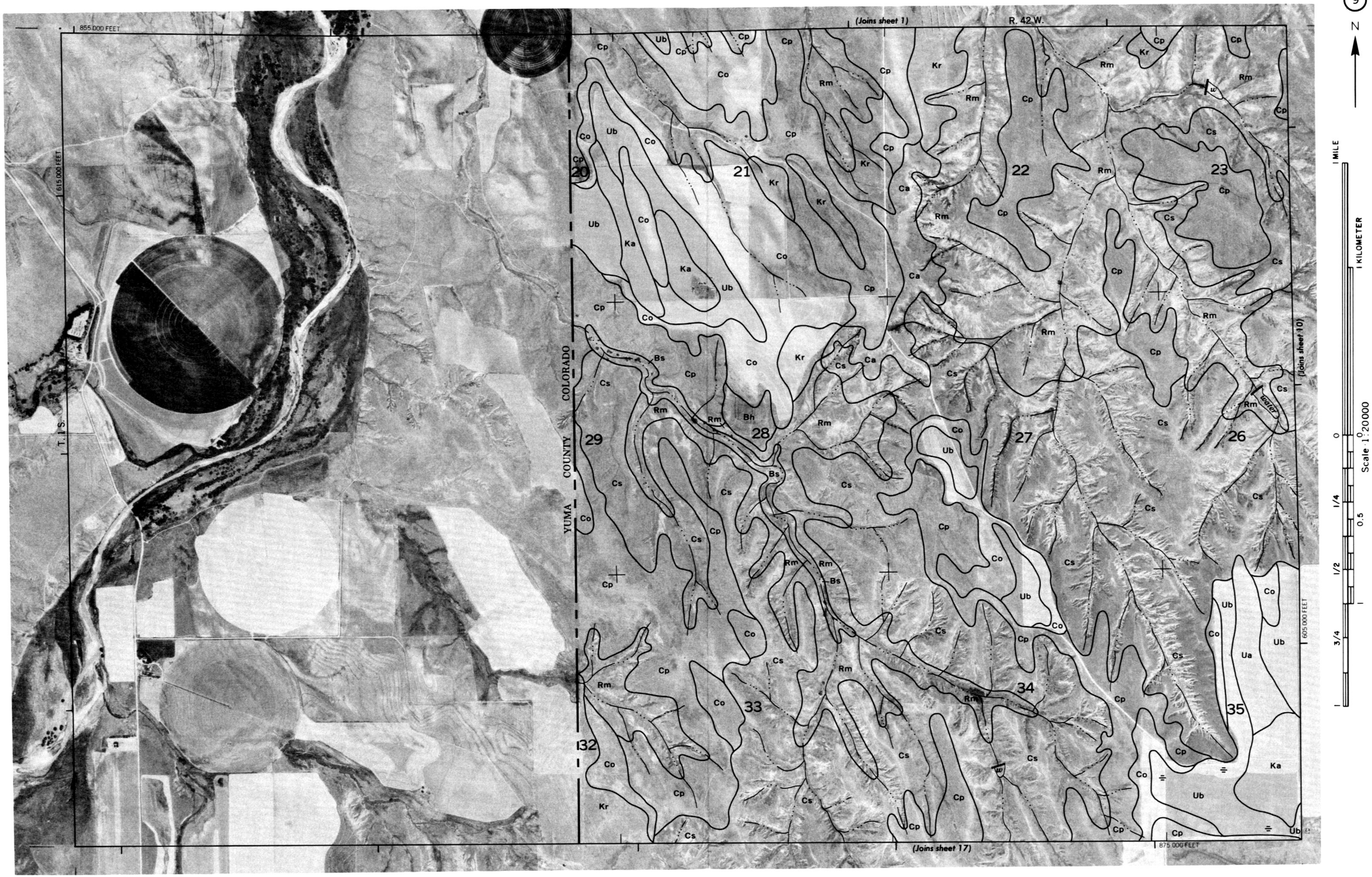
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 8

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 9



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SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 10

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 11

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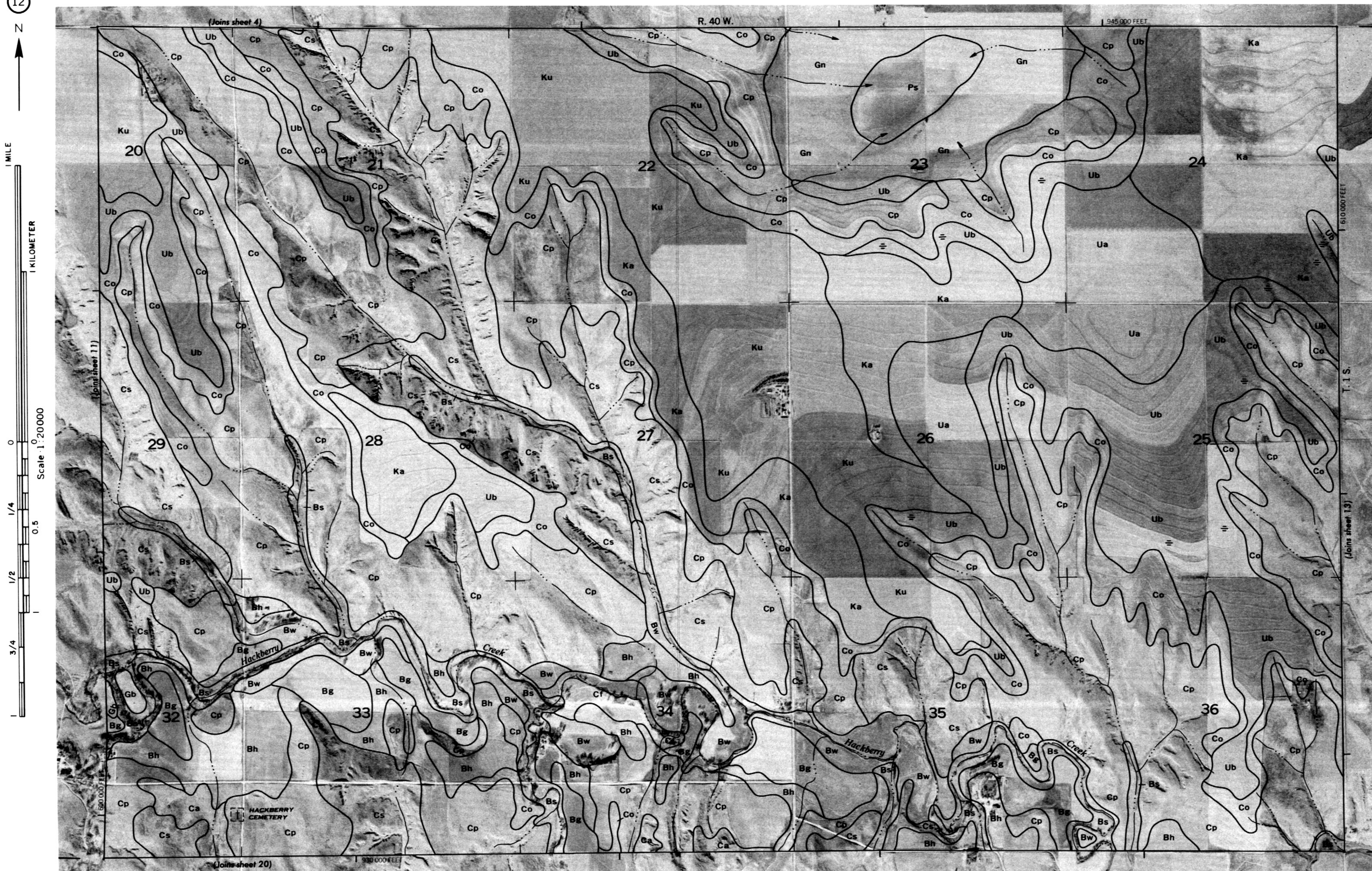
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 12



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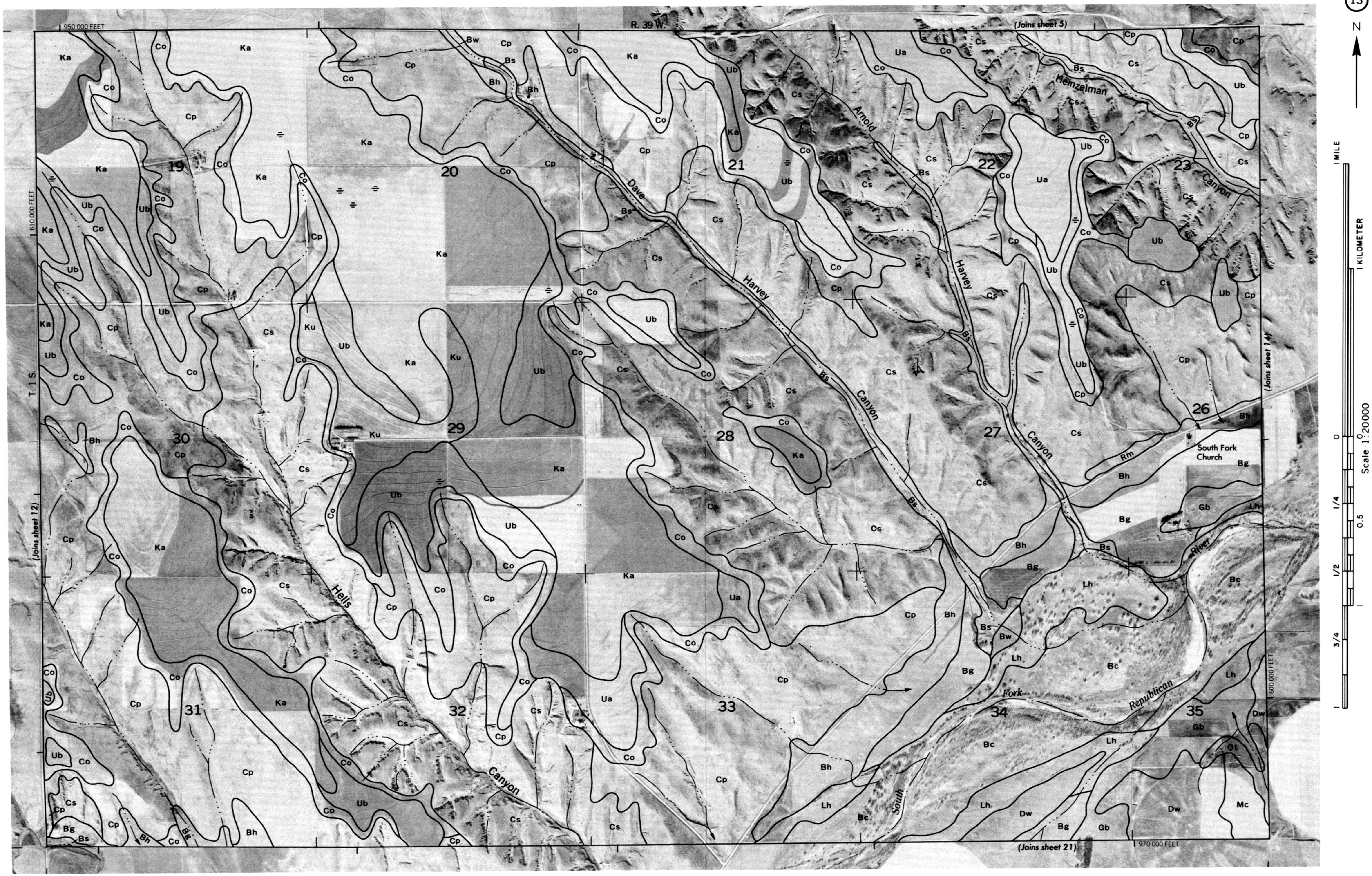

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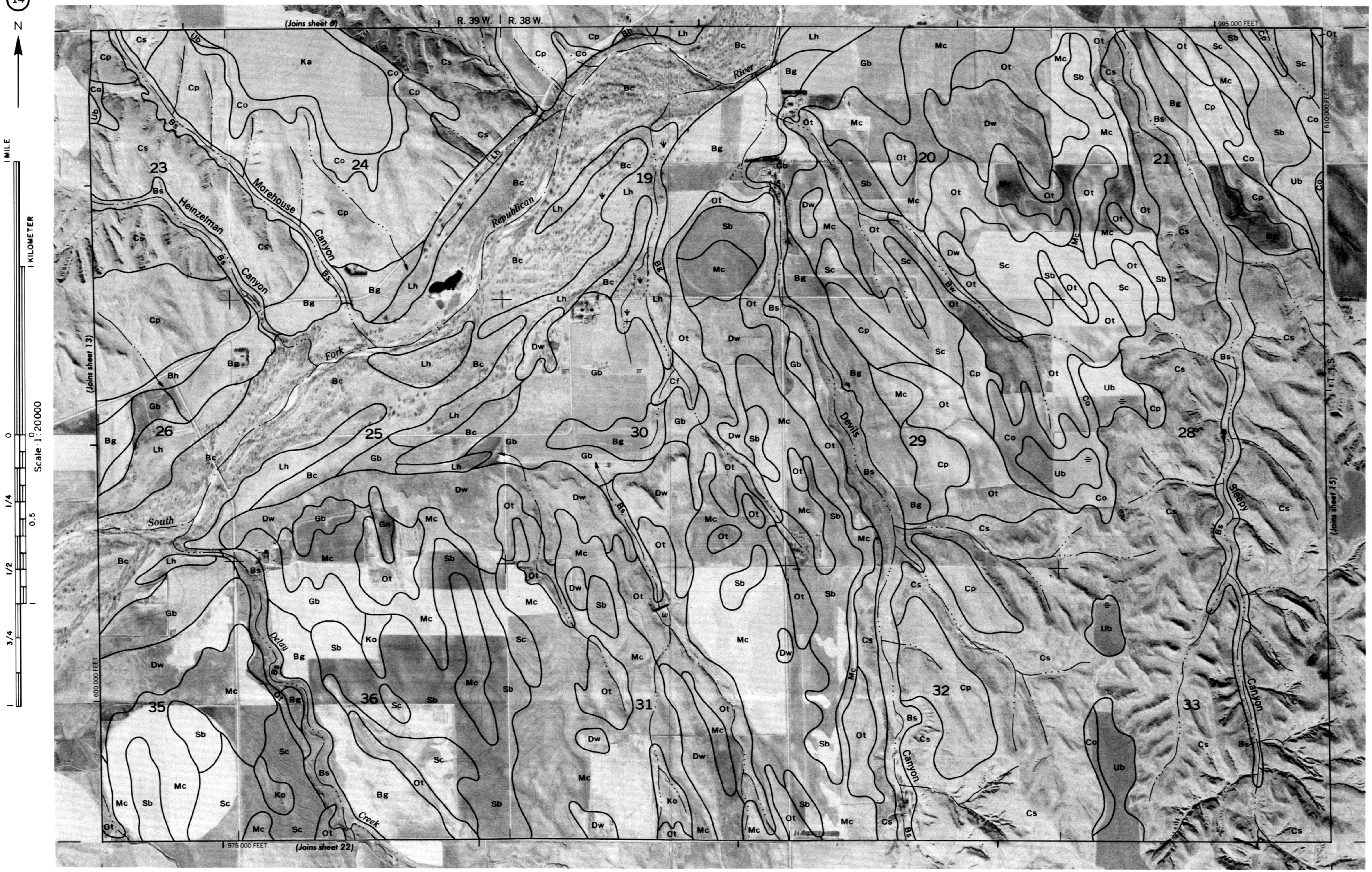

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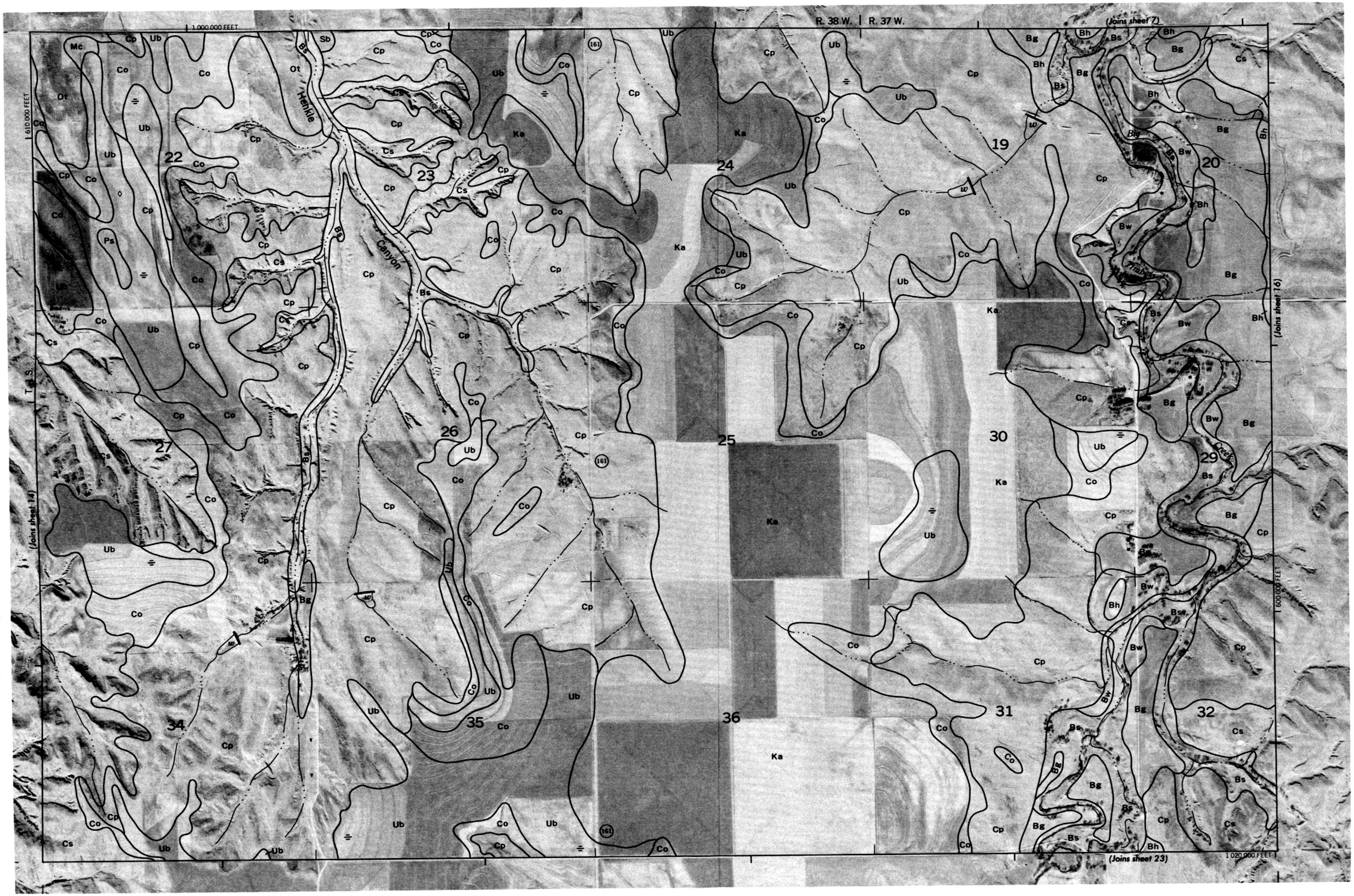

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 16

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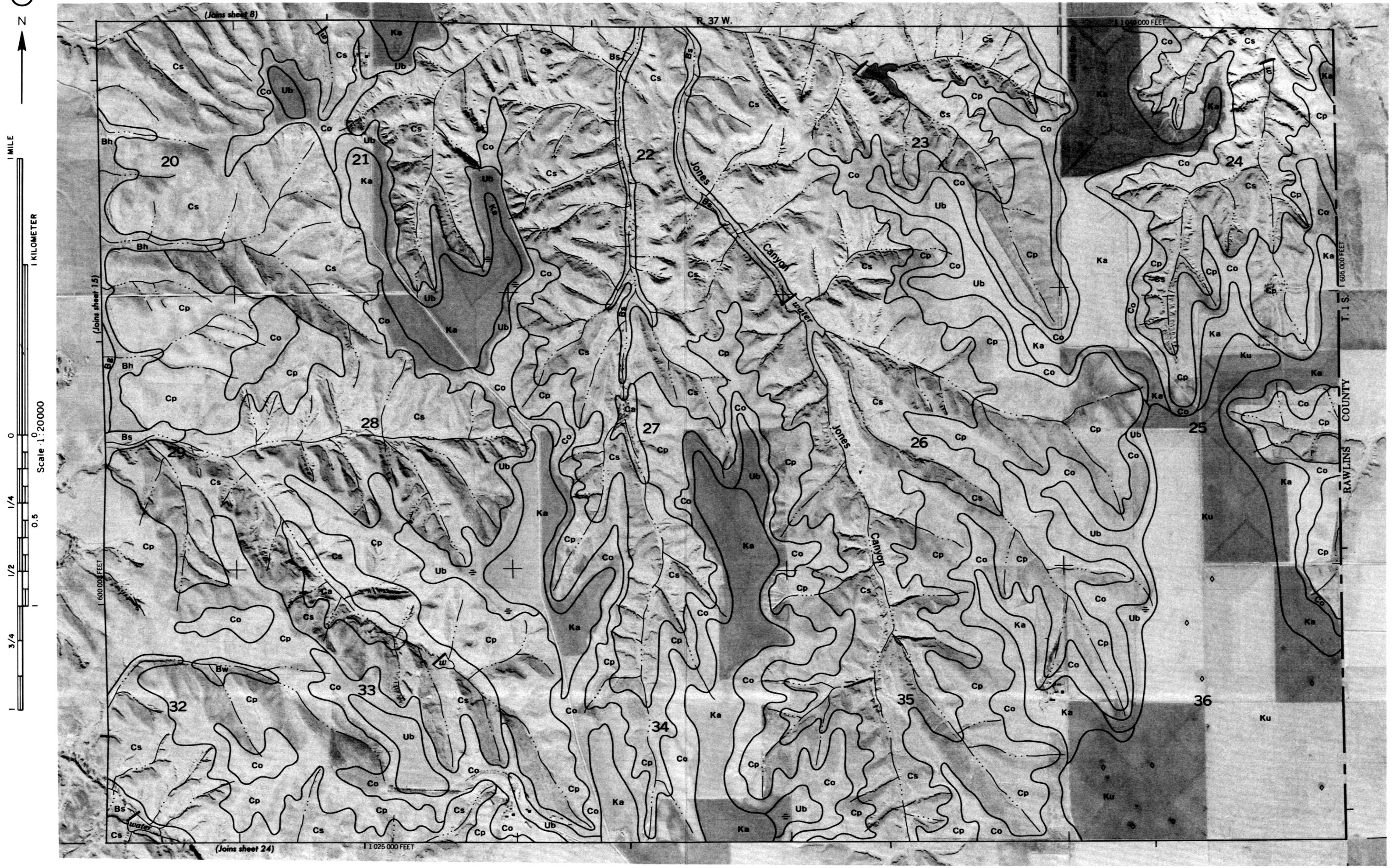
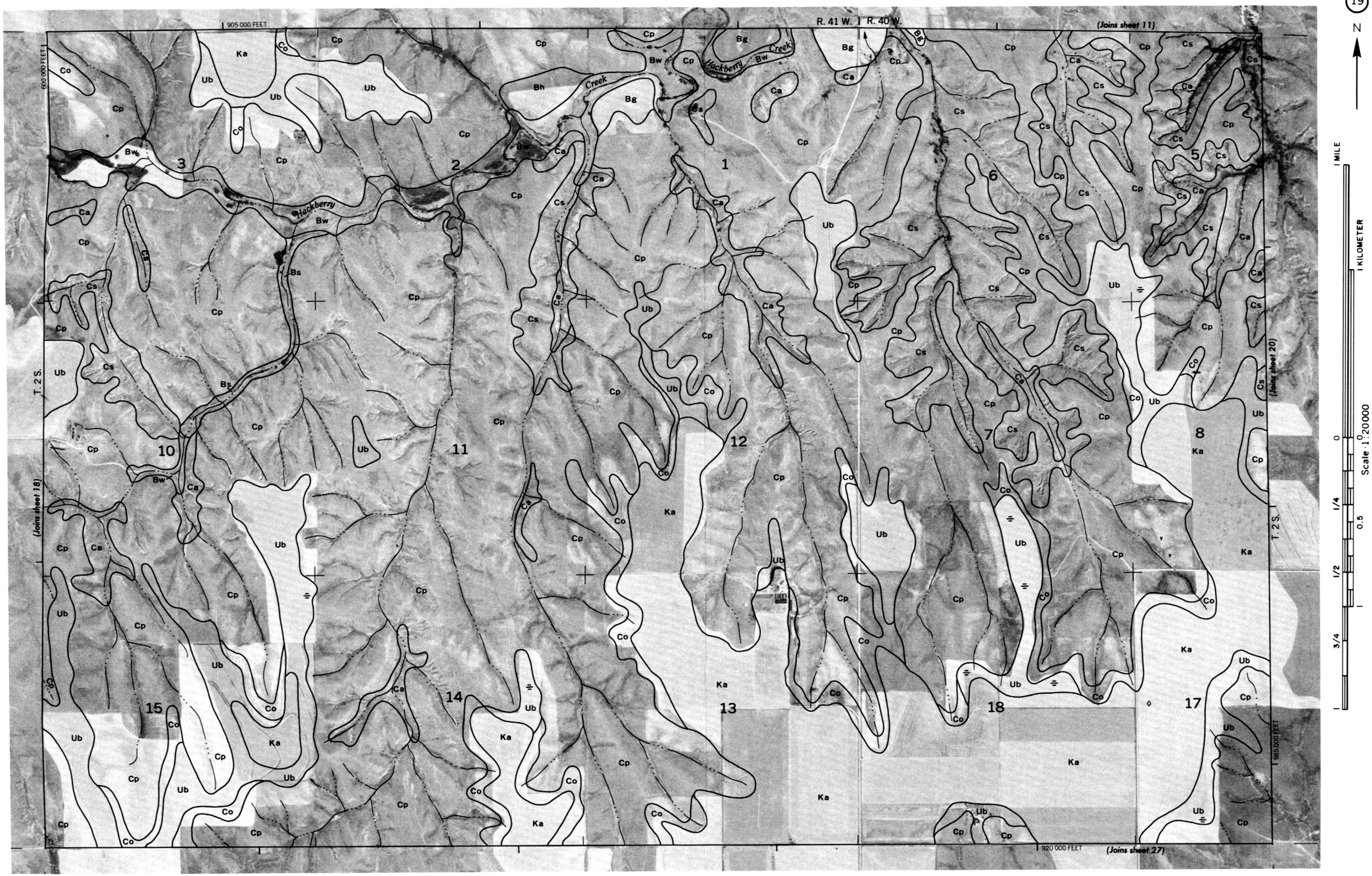
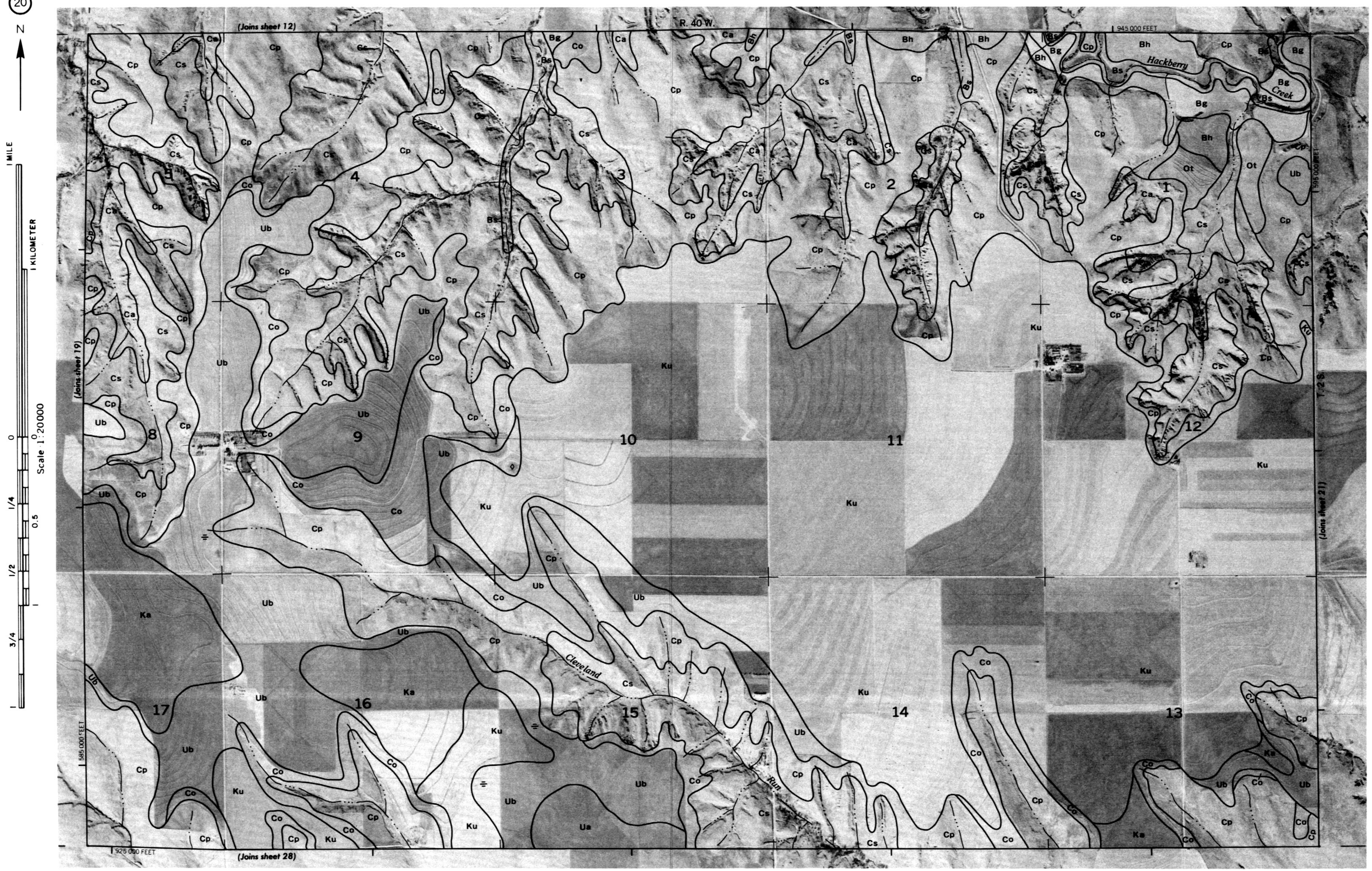


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 17

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 18

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 19

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1 KILOMETER
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3/4
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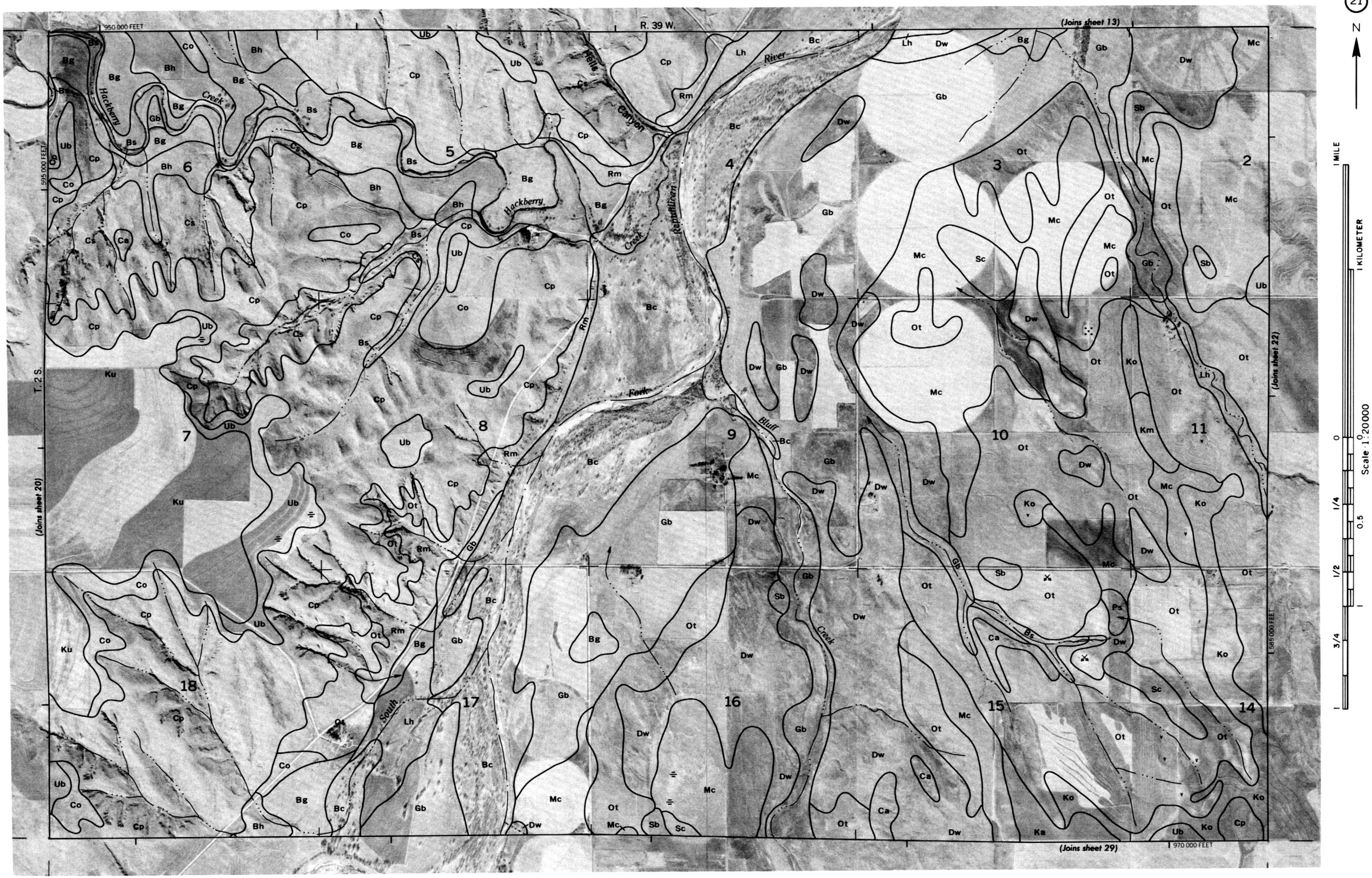
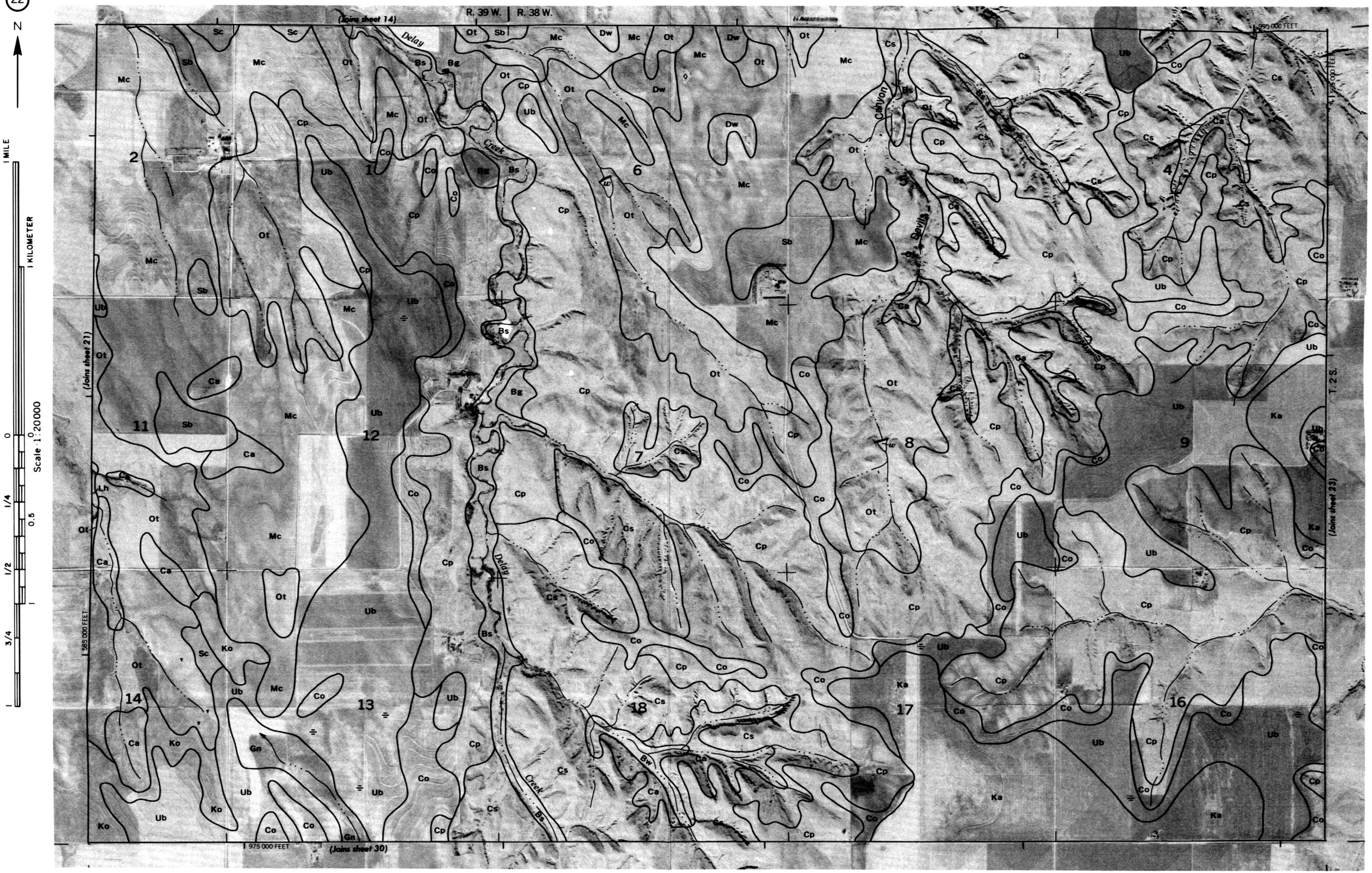
R. 40 W.
945 000 FEET
Hackberry
Creek
(Joins sheet 19)
(Joins sheet 21)
T. 2 S.
595 000 FEET
585 000 FEET
925 000 FEET
(Joins sheet 28)
Cleveland
Run
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

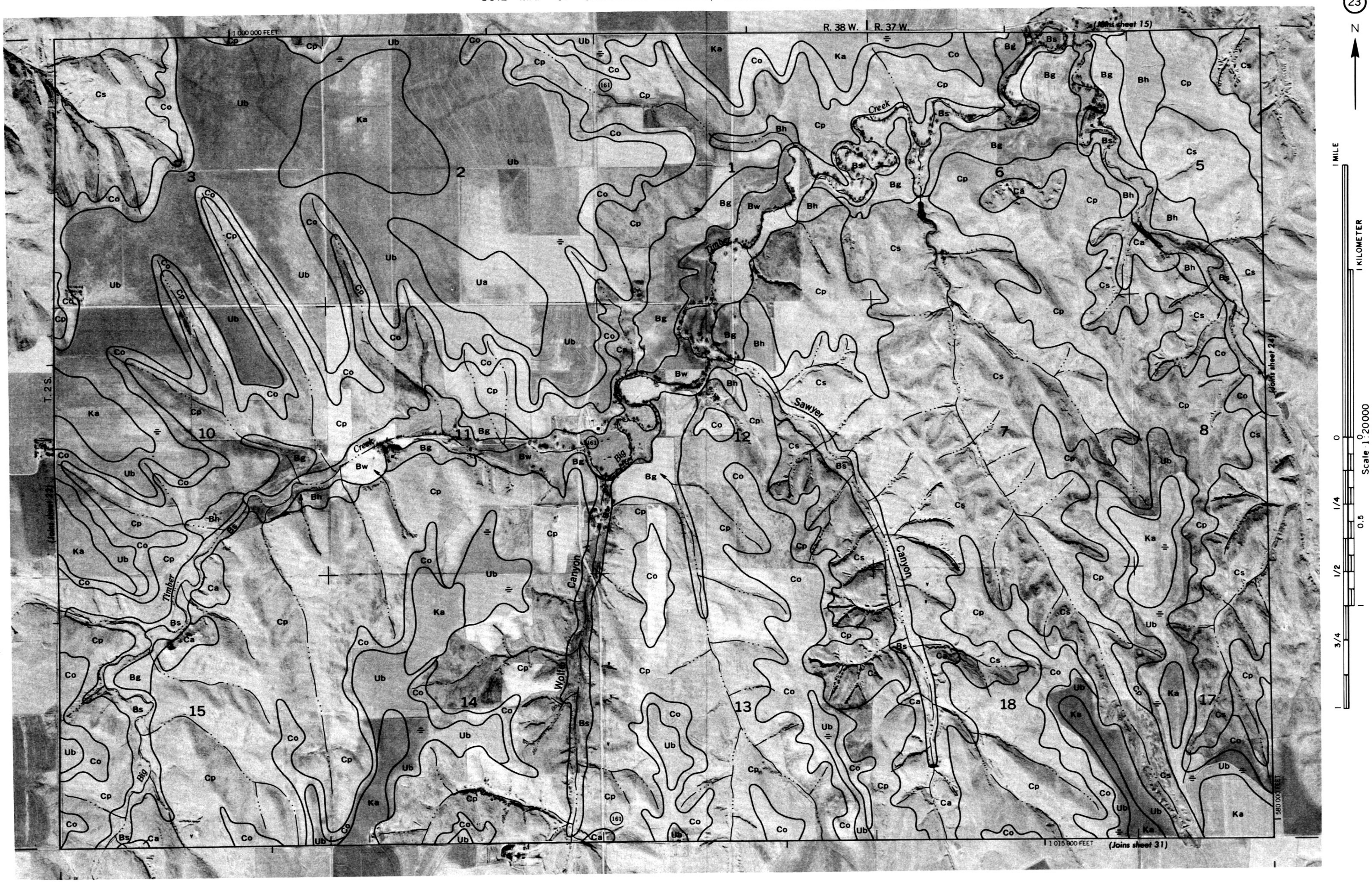
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 21



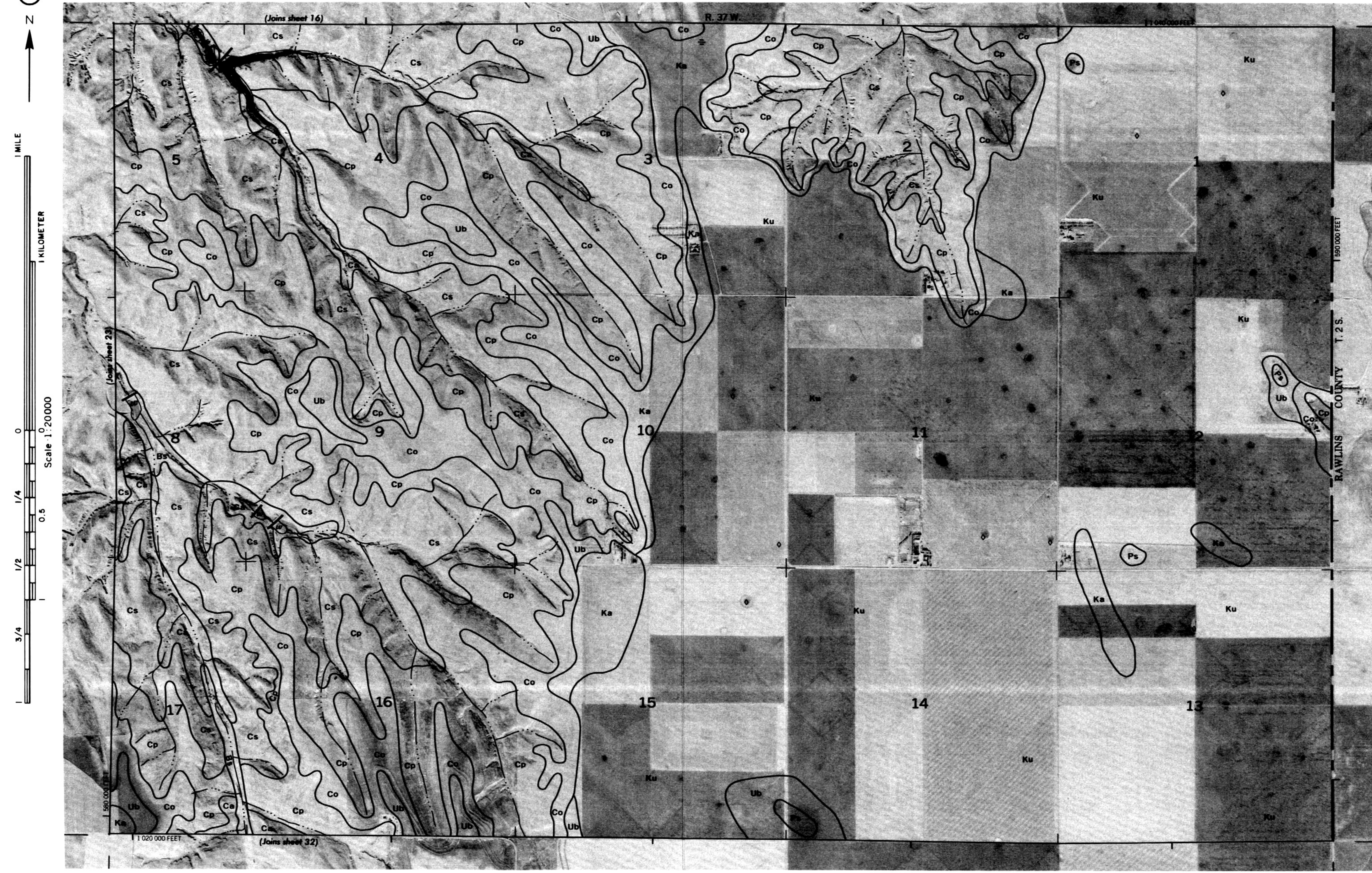
22

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 22




23
N
R. 38 W.
R. 37 W.
T. 2 S.
1 000 000 FEET
1 015 000 FEET
580 000 FEET
(Joins sheet 15)
(Joins sheet 24)
(Joins sheet 31)
(Joins sheet 22)
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
Timber Creek
Sawyer Canyon
Big Timber Creek
Wolf Canyon
Big
Creek
Canyon
161

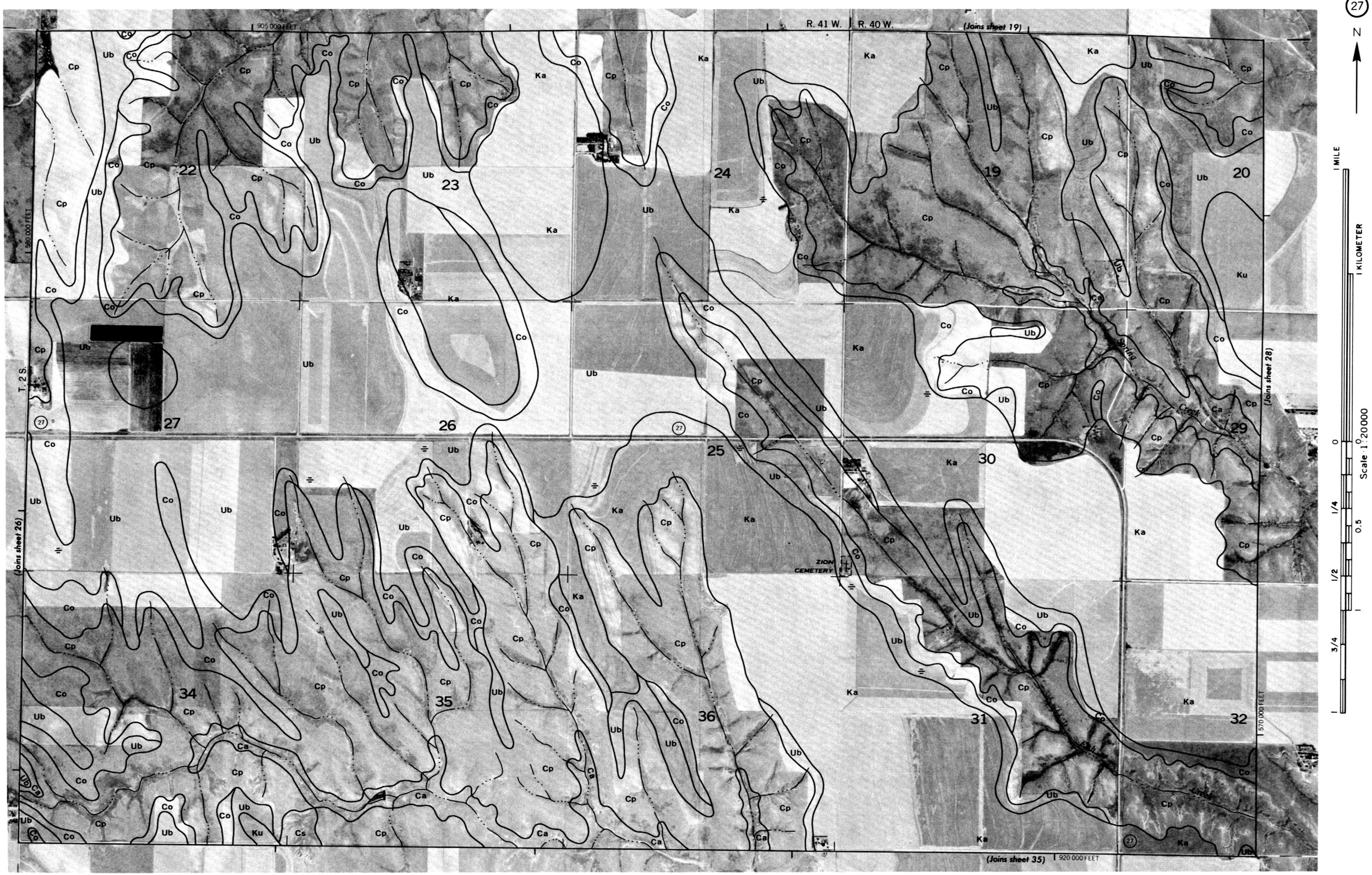
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 24



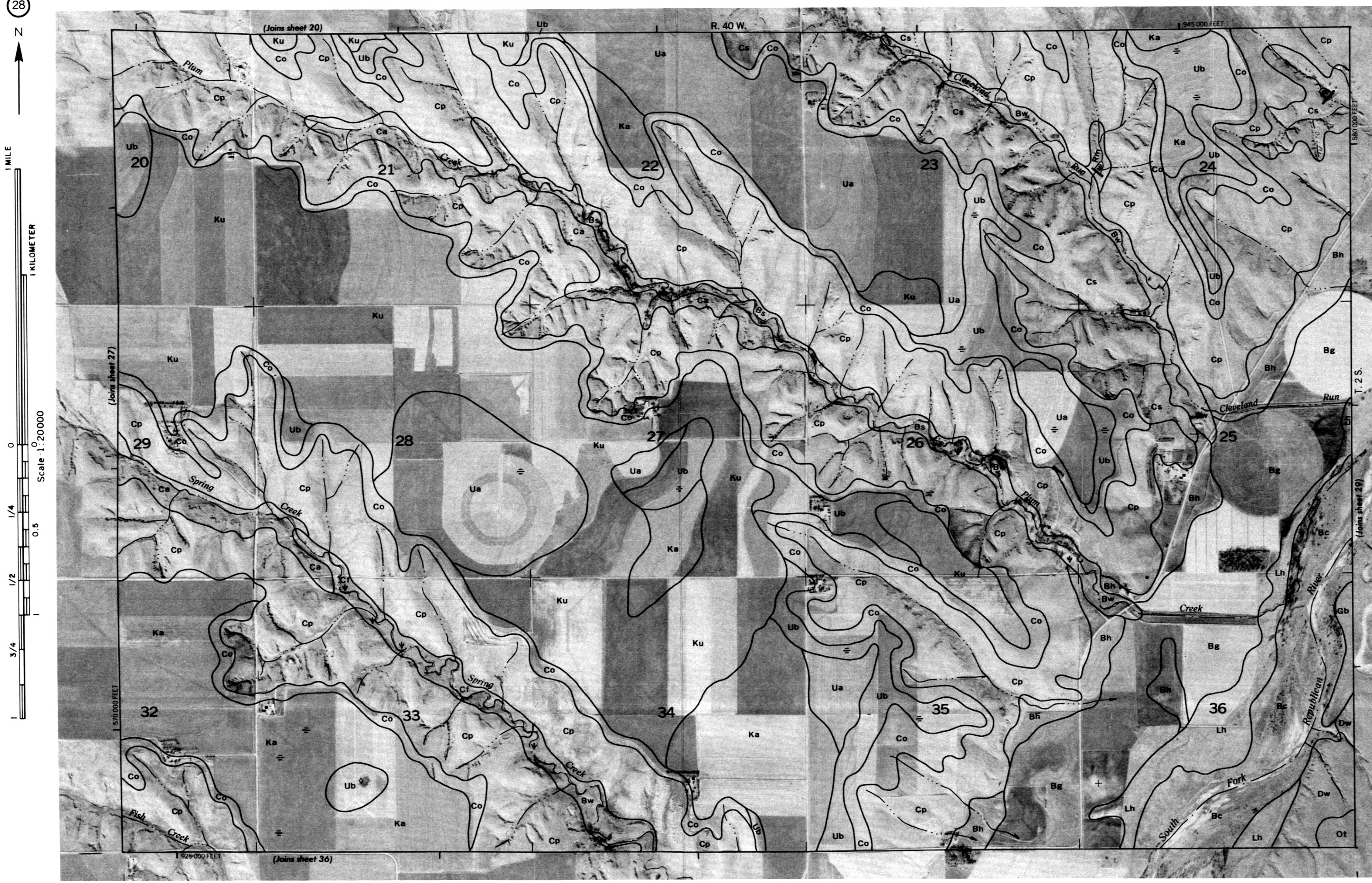
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 25

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 26

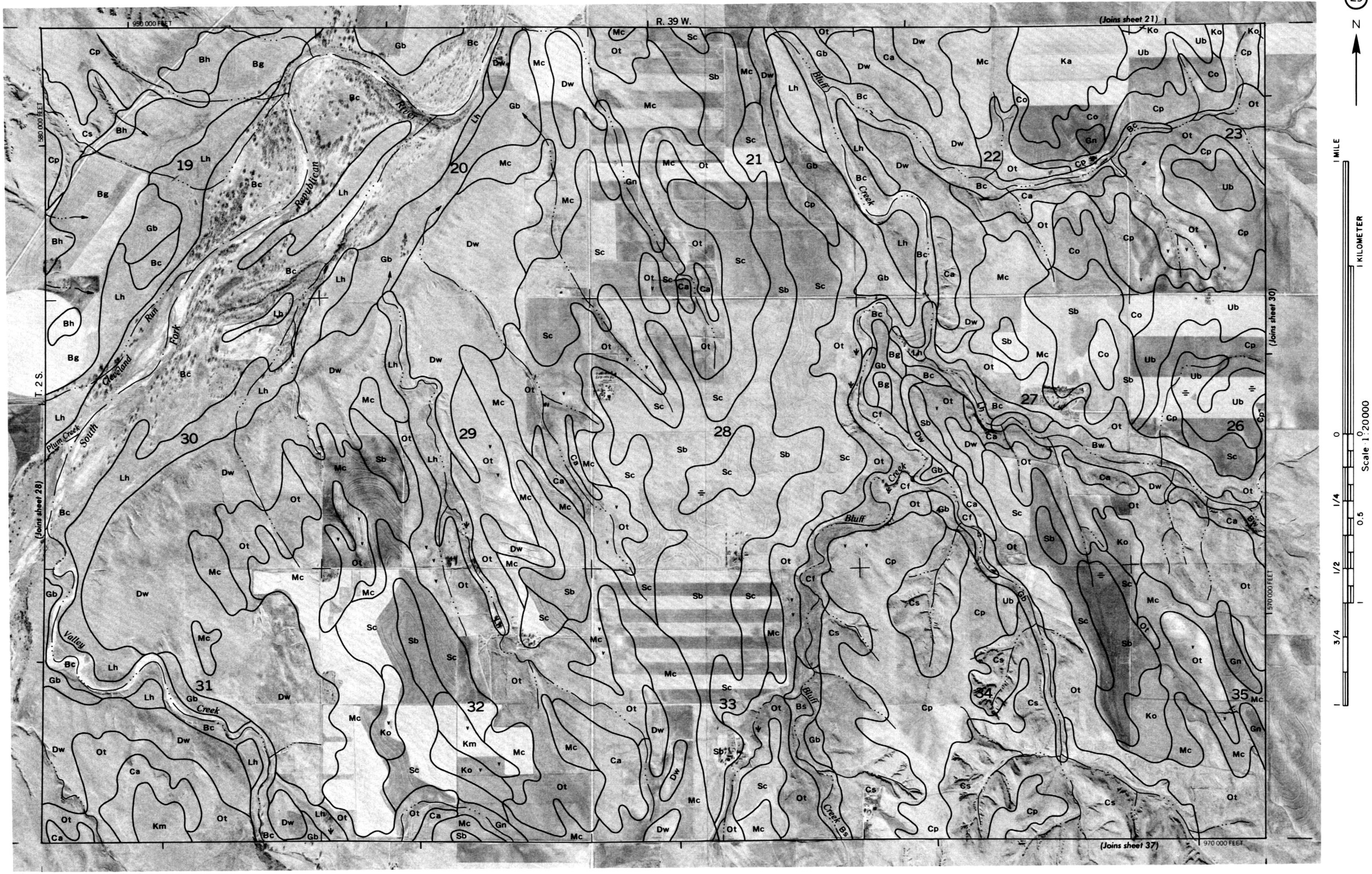
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 27



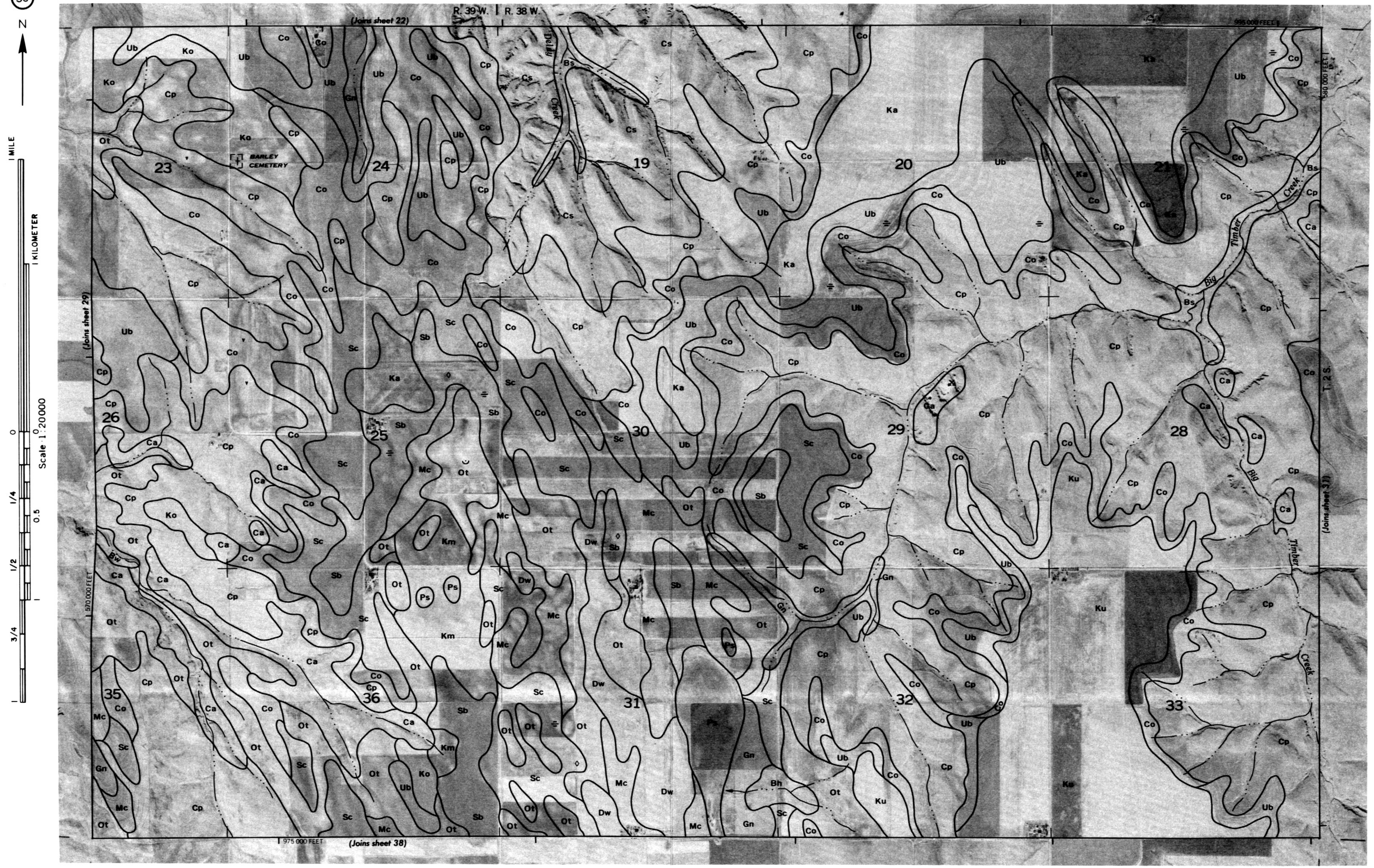
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 28



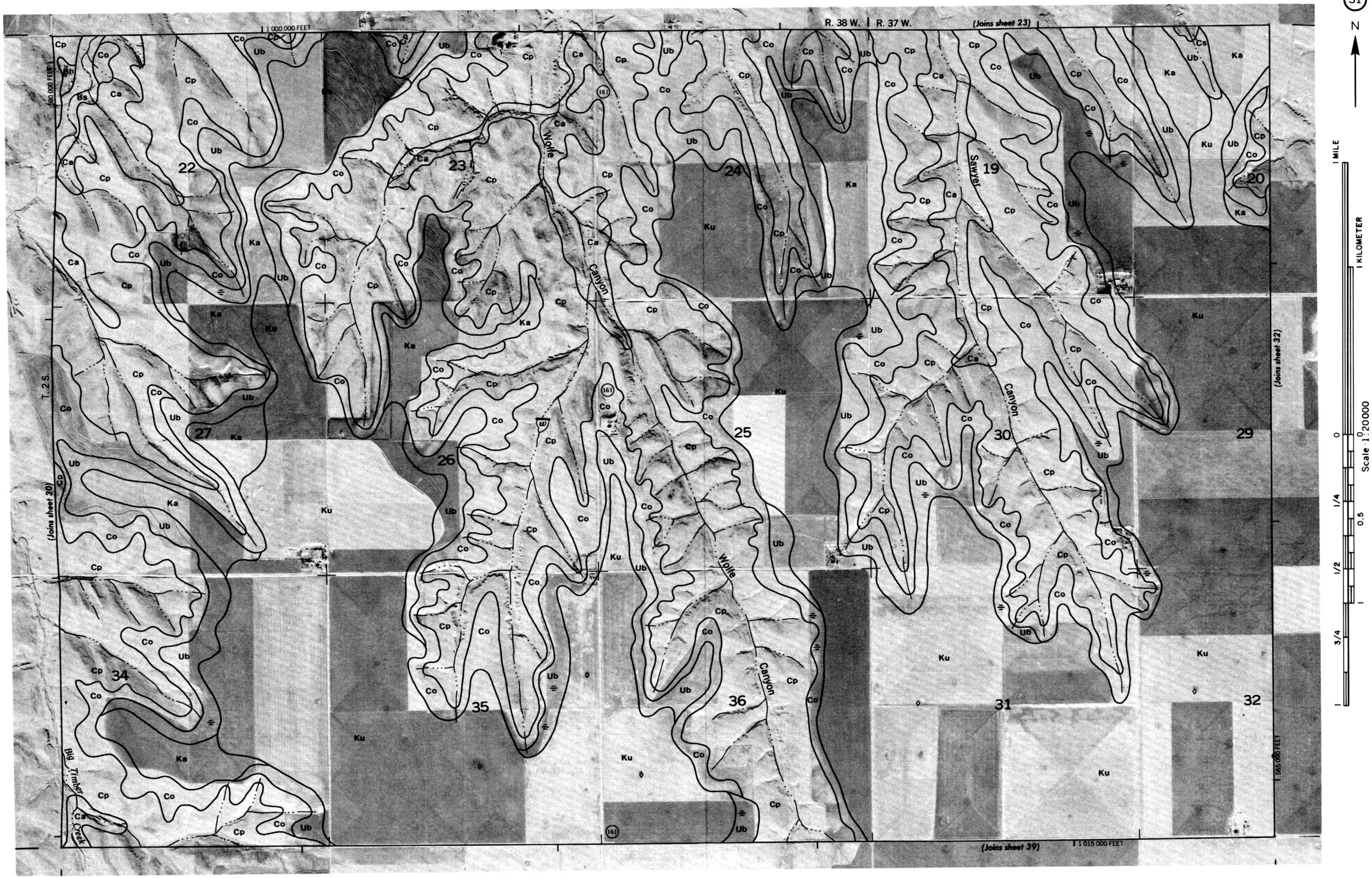
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 29



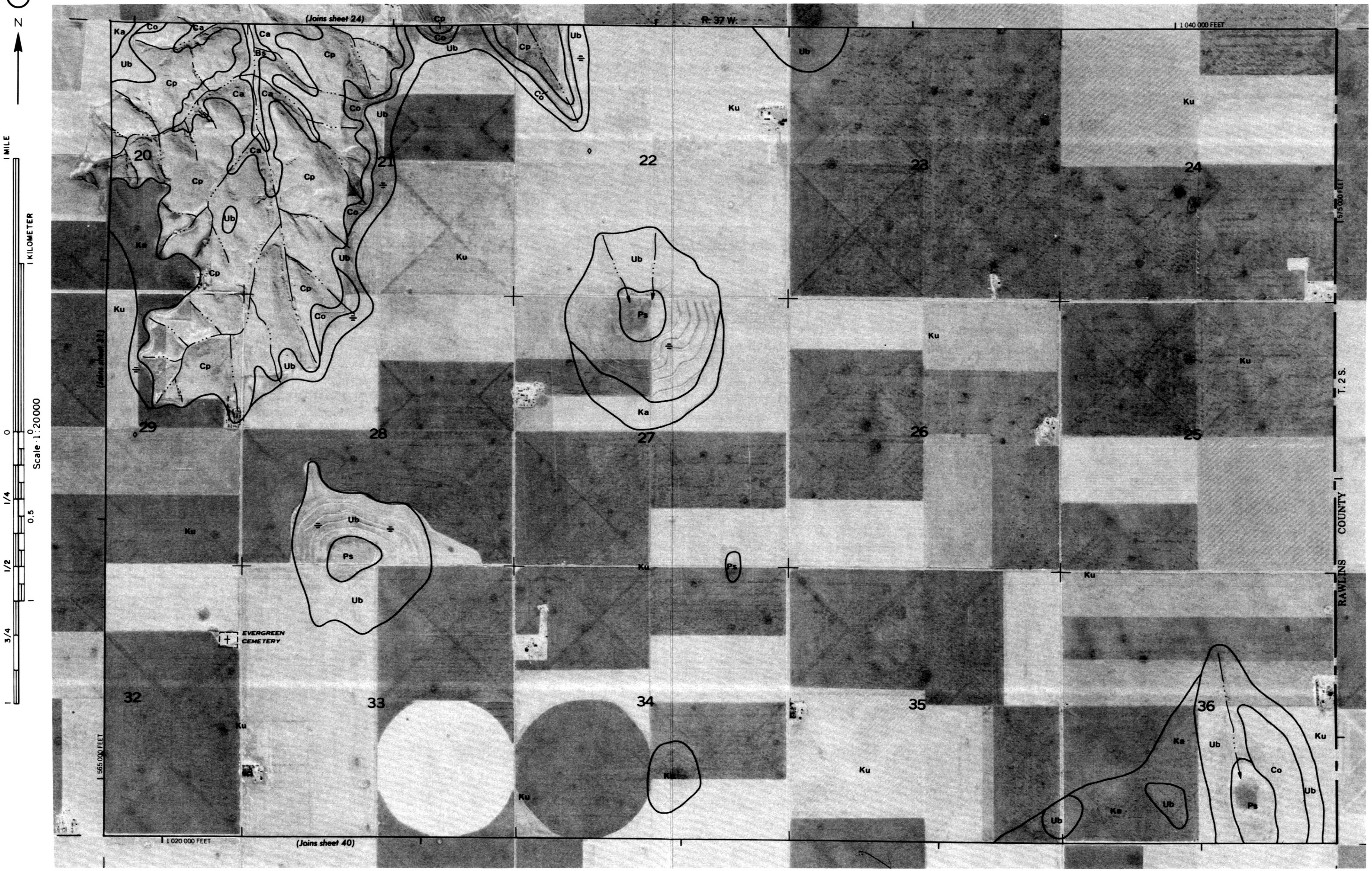
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 30



SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 31

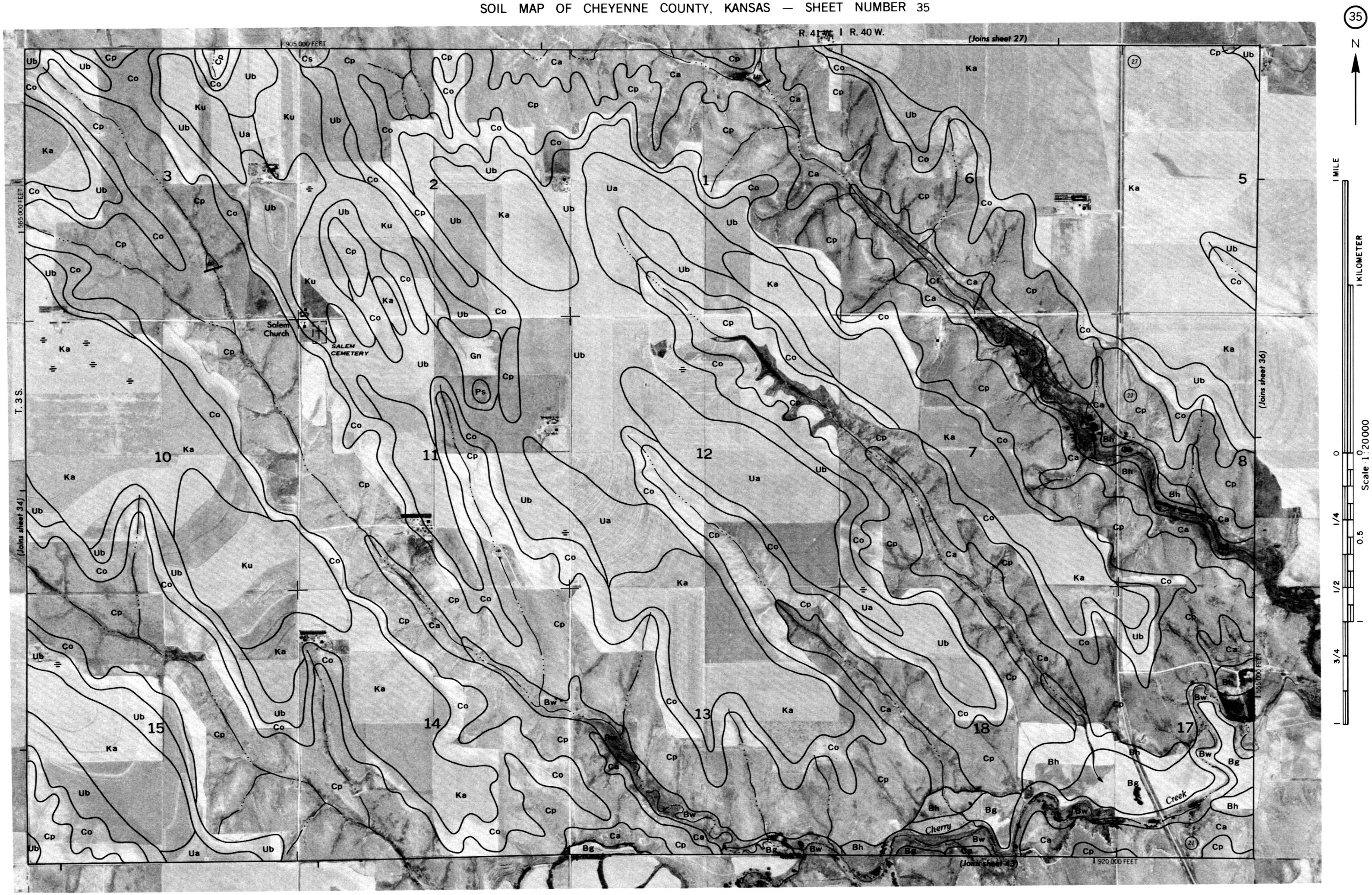


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 32



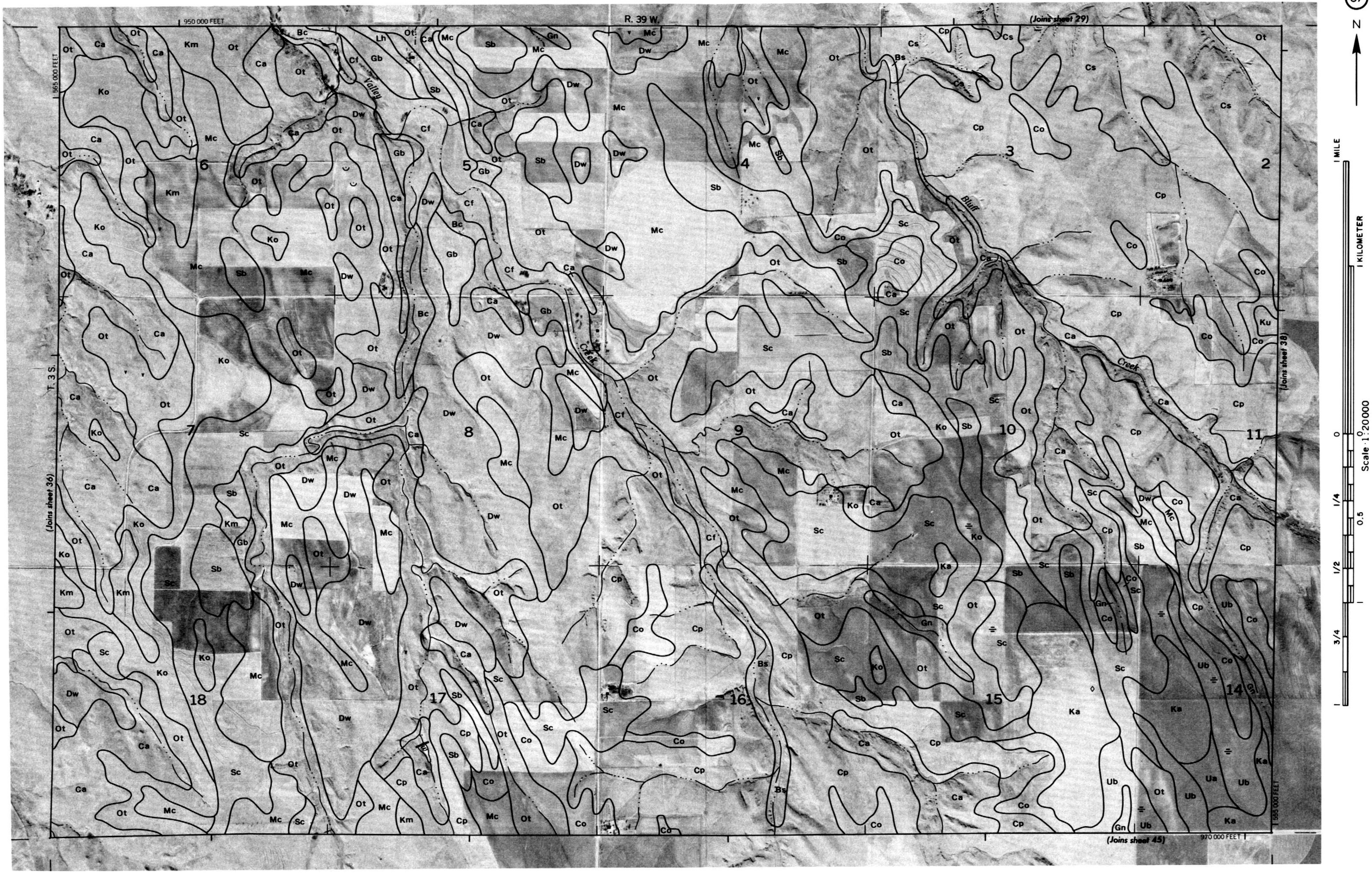
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 33

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 34

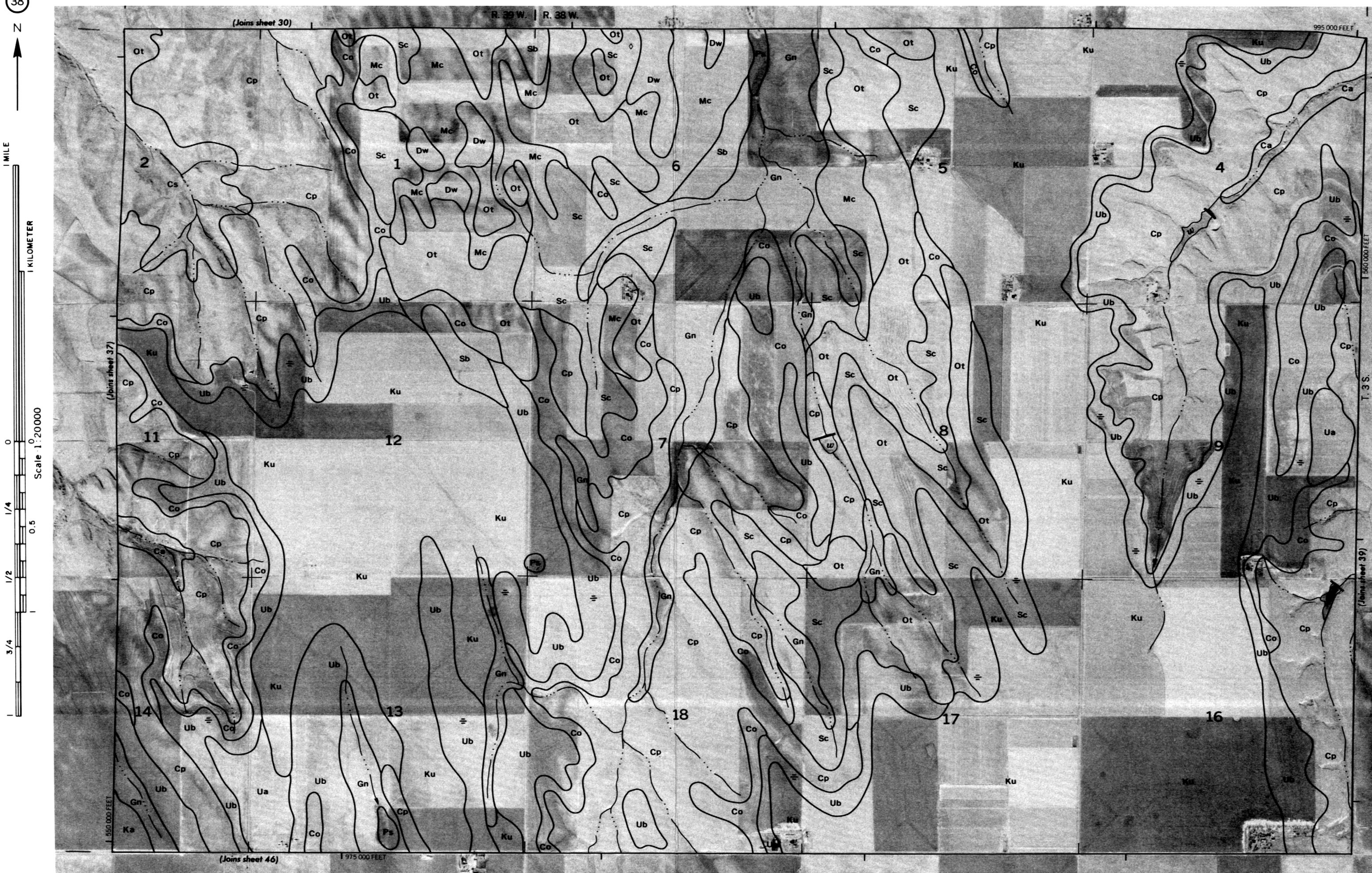

35
N
R. 41 W. | R. 40 W.
905 000 FEET
(Joins sheet 27)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 43)
565 000 FEET
555 000 FEET
920 000 FEET
T. 3 S.
Salem Church
SALEM CEMETERY
Cherry
Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 44)
R. 40 W.
T. 3 S.
945 000 FEET
925 000 FEET
365 000 FEET
355 000 FEET
Fish Creek
Spring Creek
Republican River
South Fork Republican
Sand Creek
Cherry Creek
BURLINGTON NORTHERN

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 37

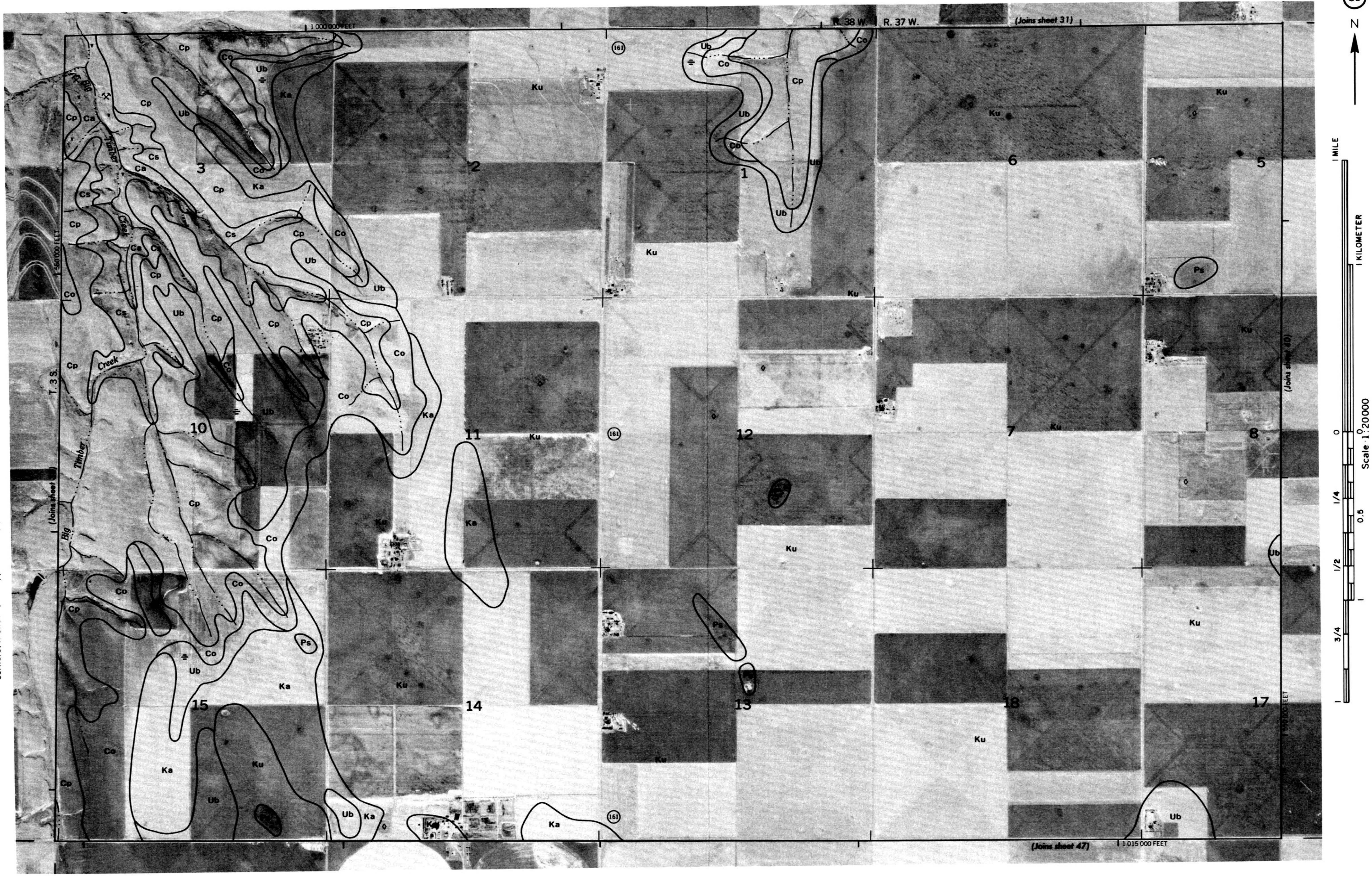


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 38

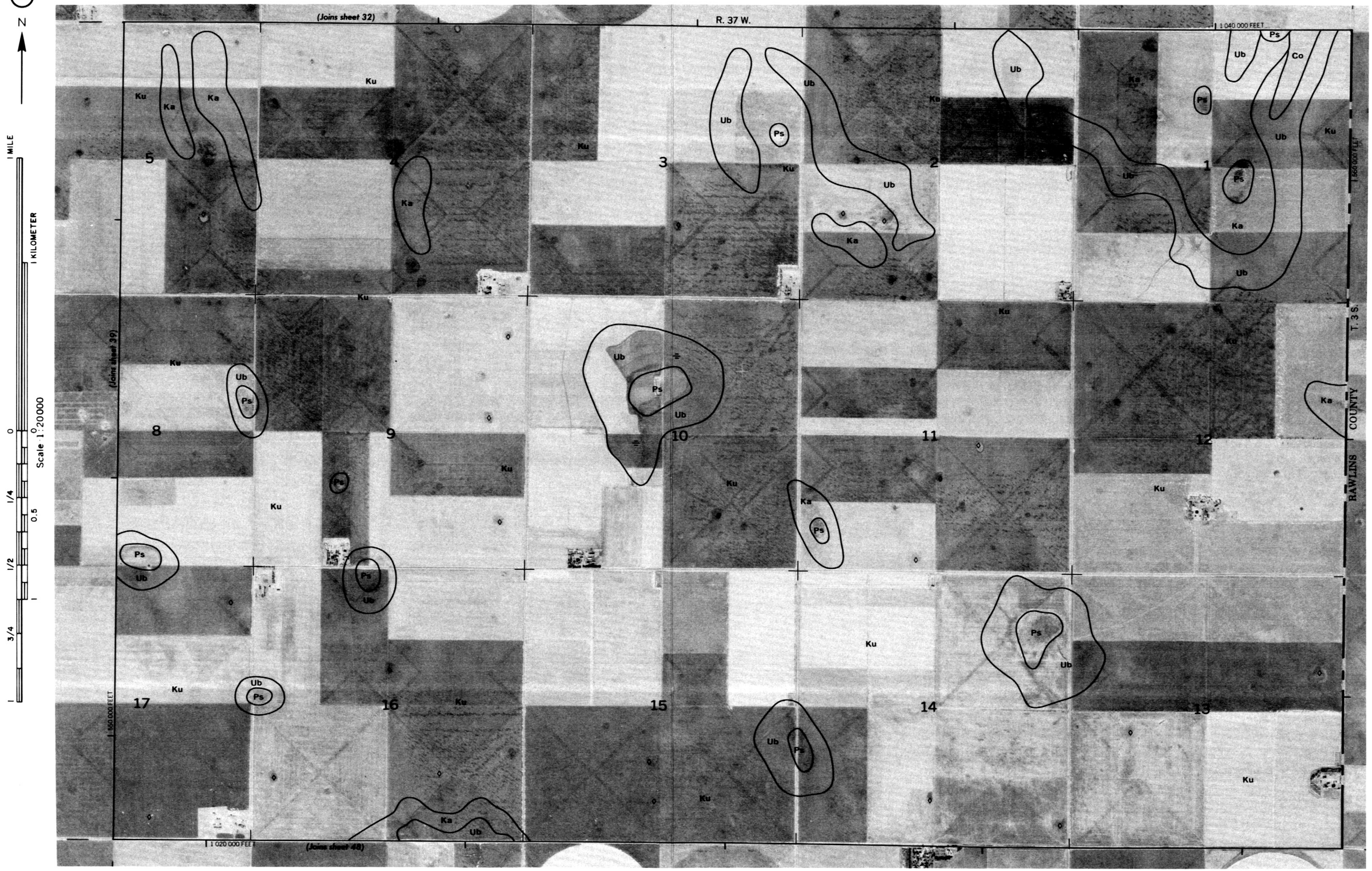


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 39

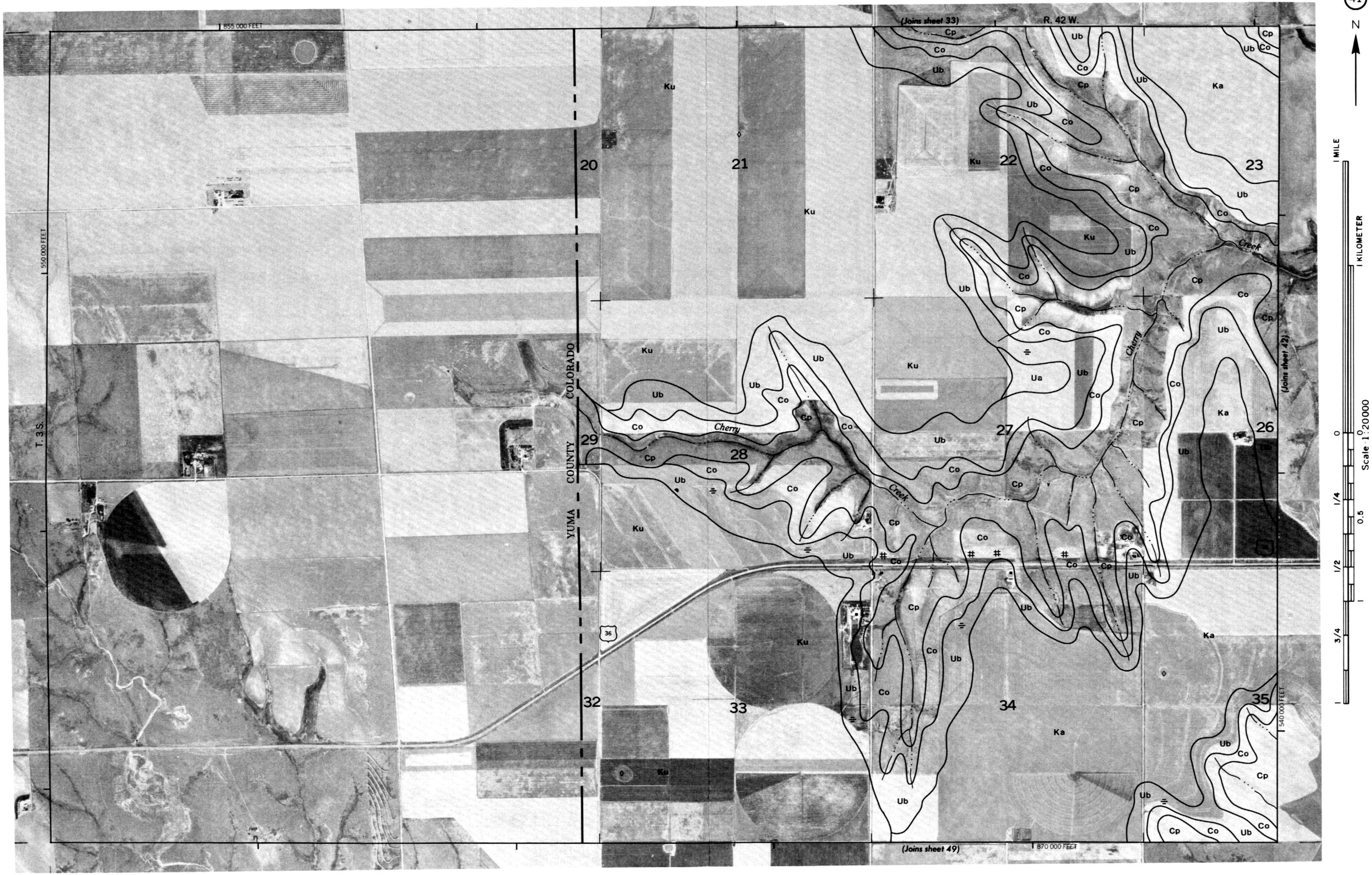
39



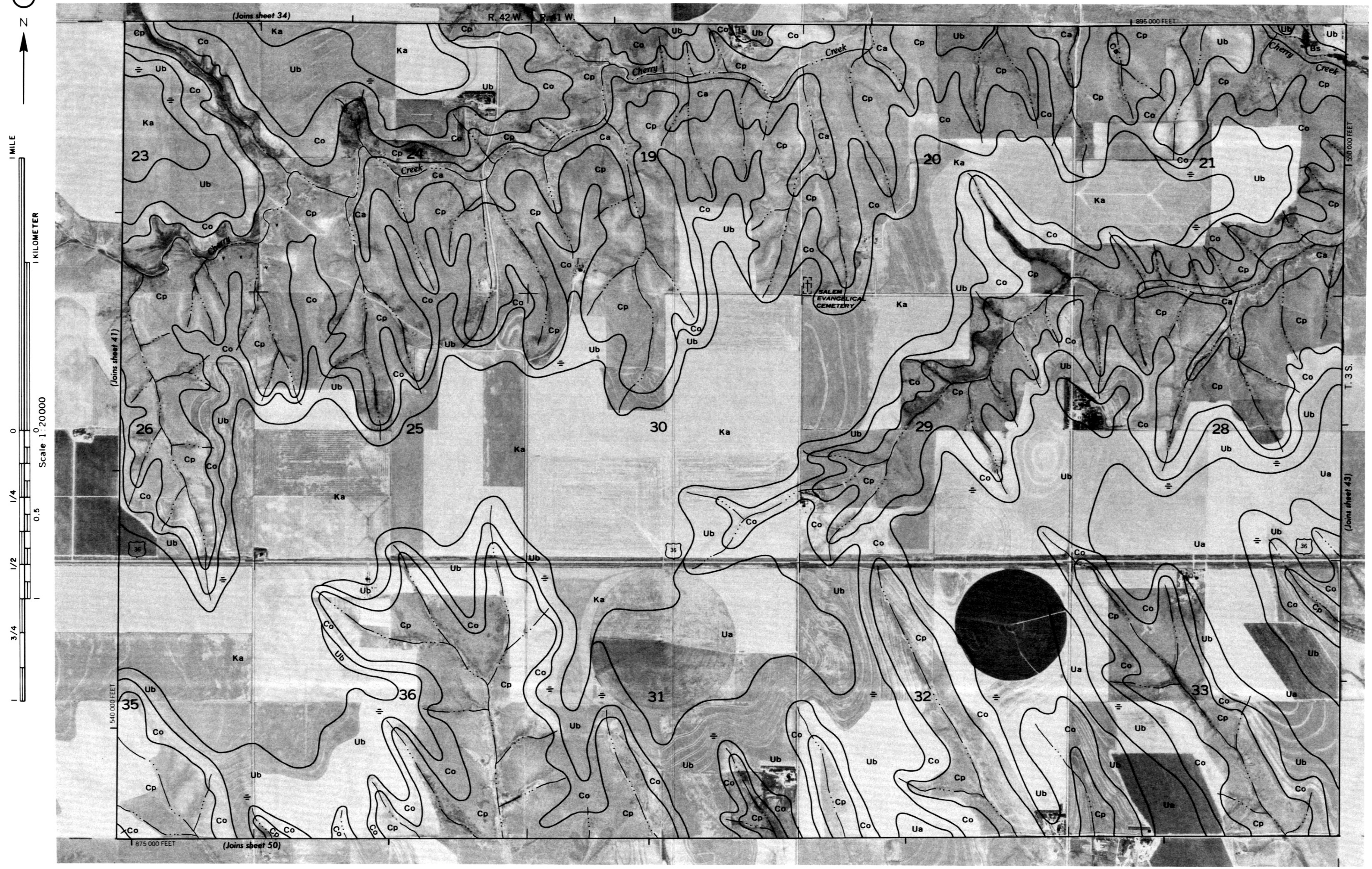
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 40



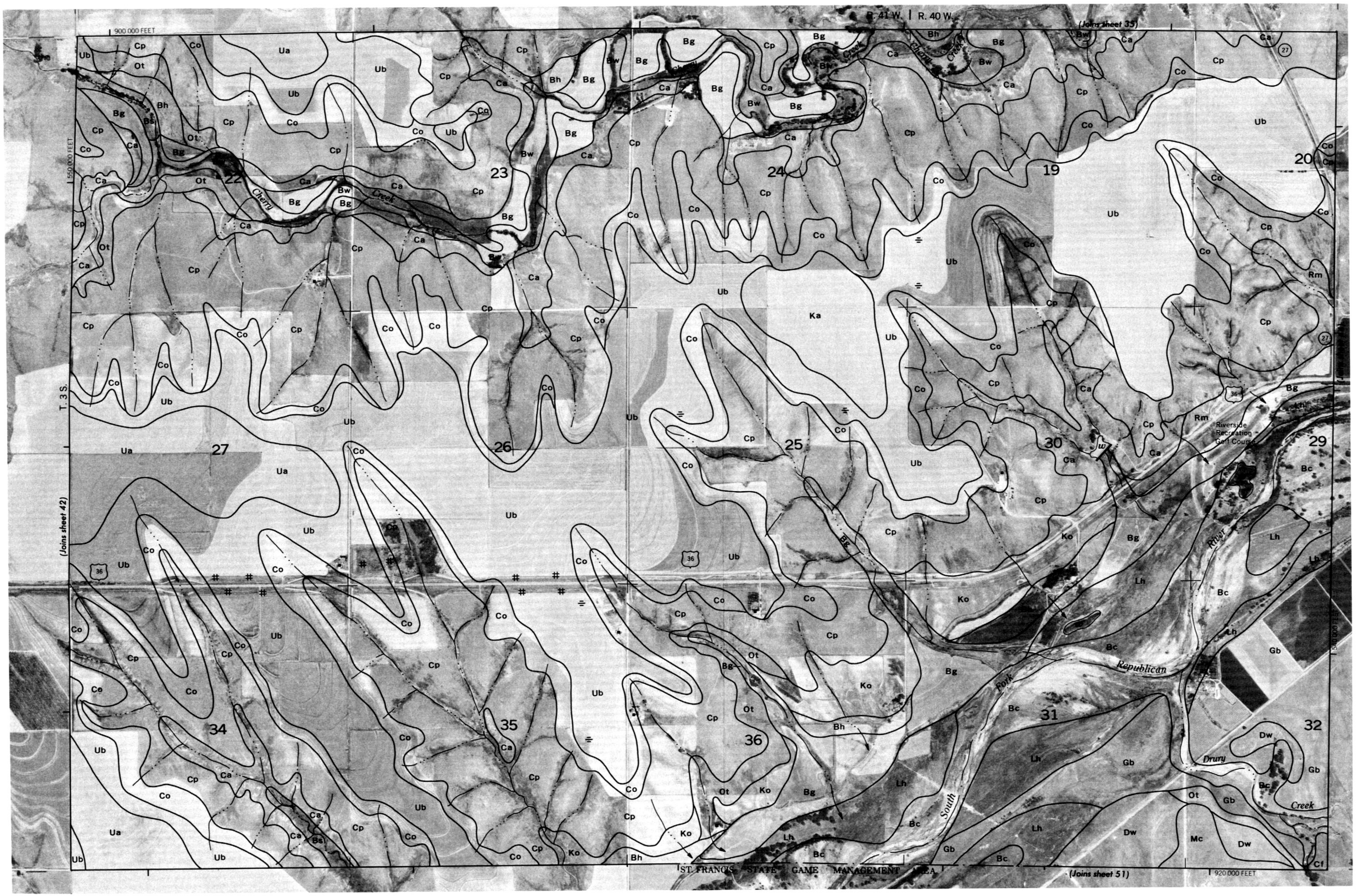
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 41



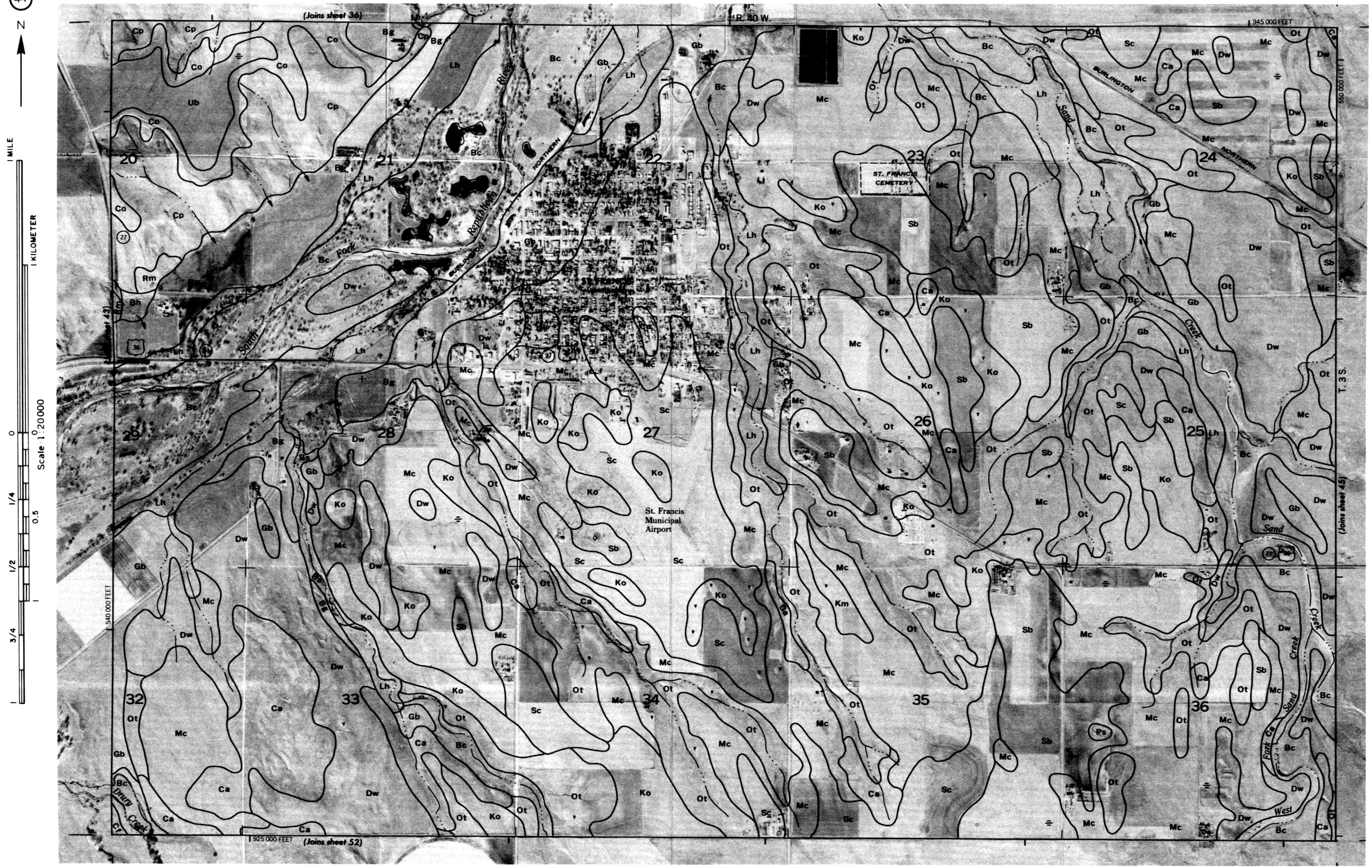
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 42



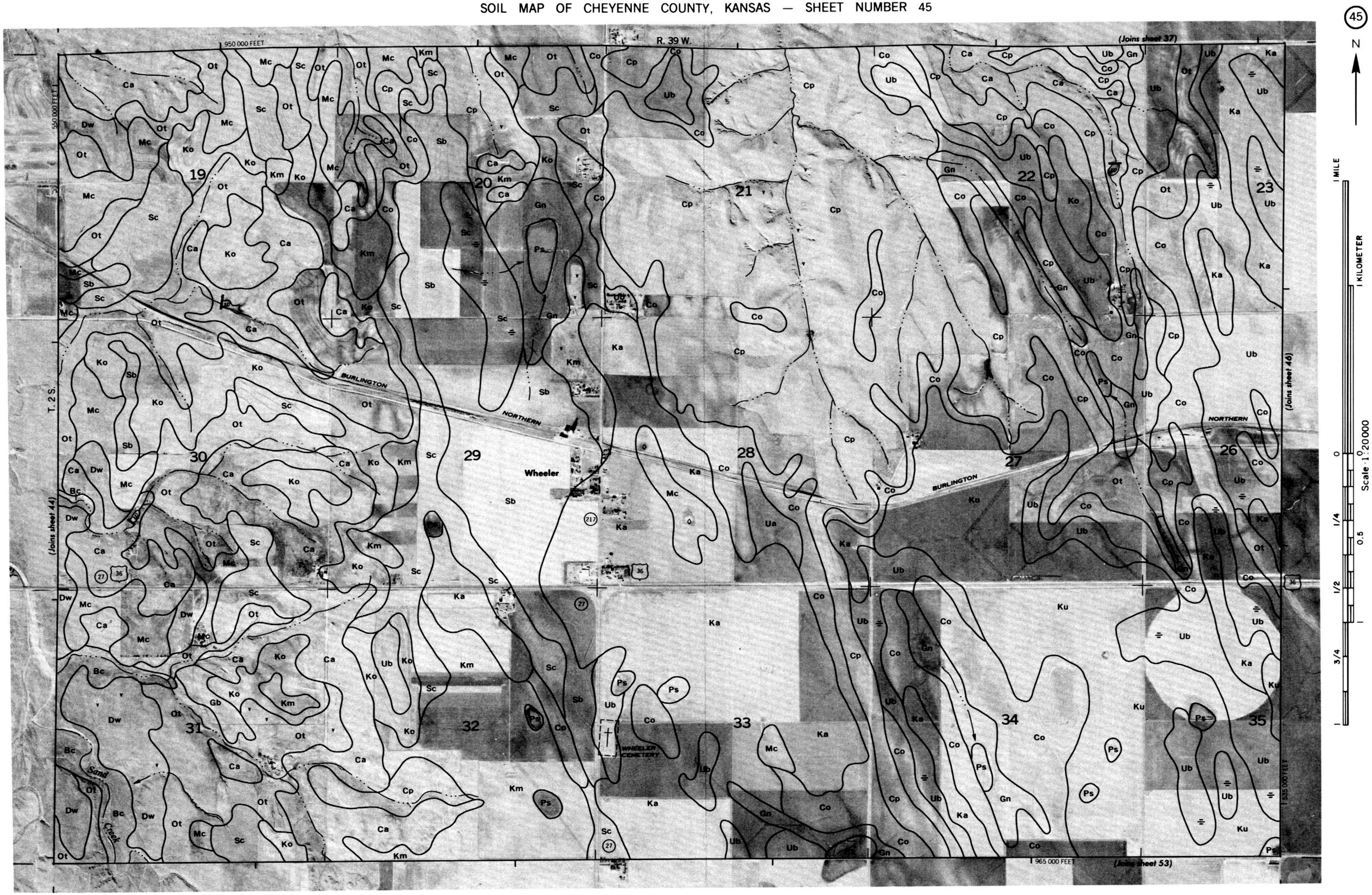
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 43



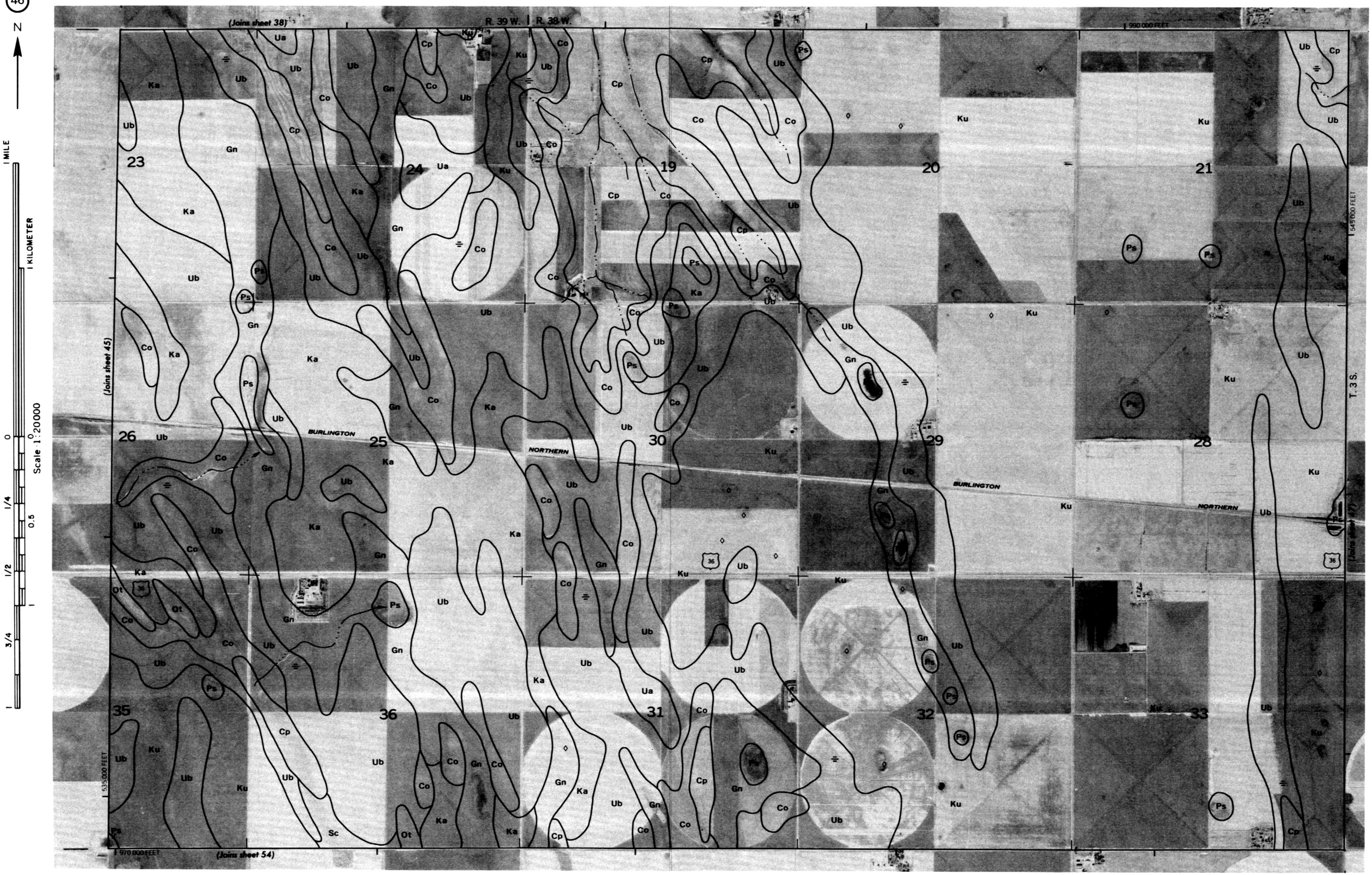
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 44

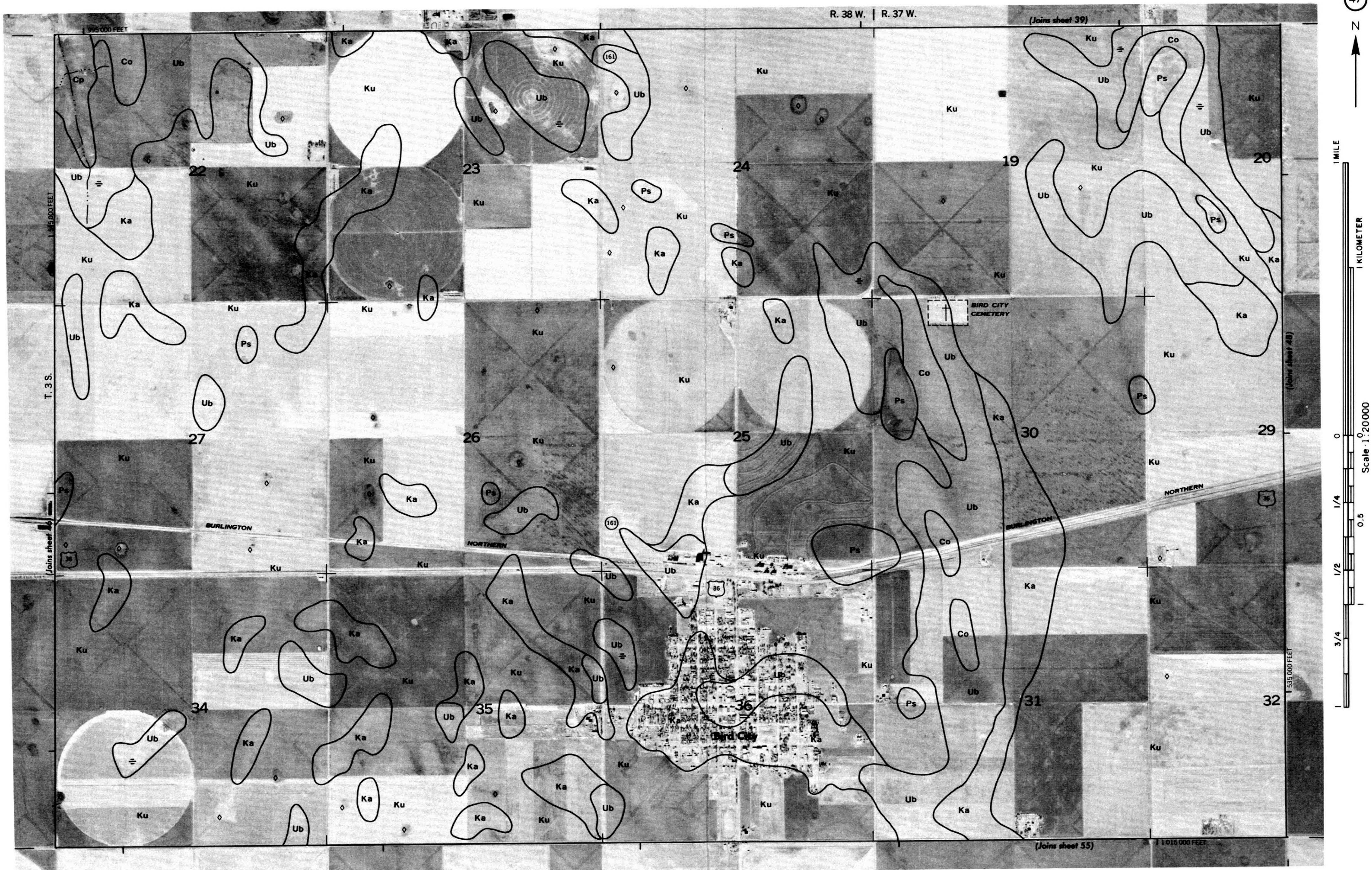


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 45

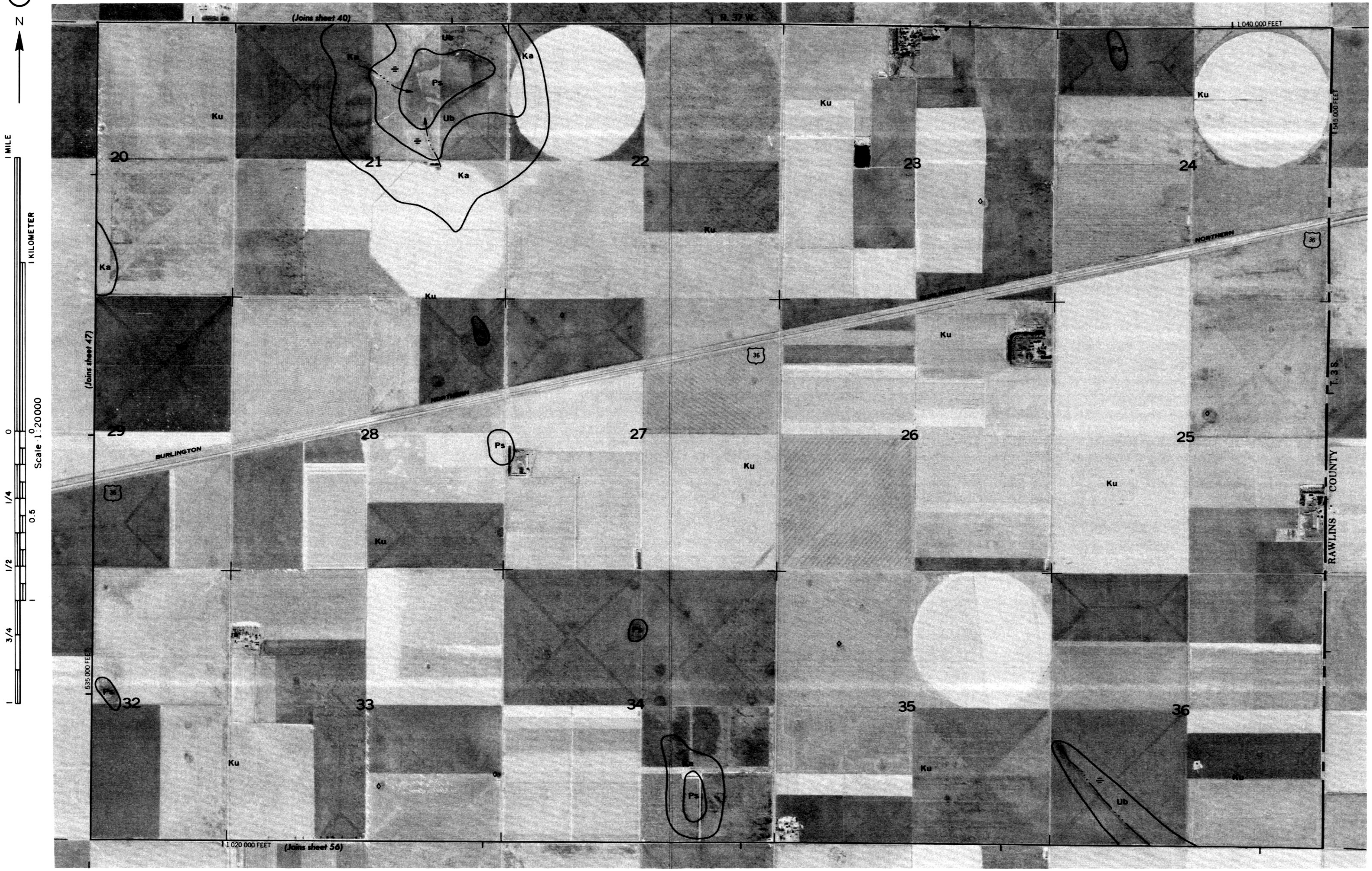


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 46



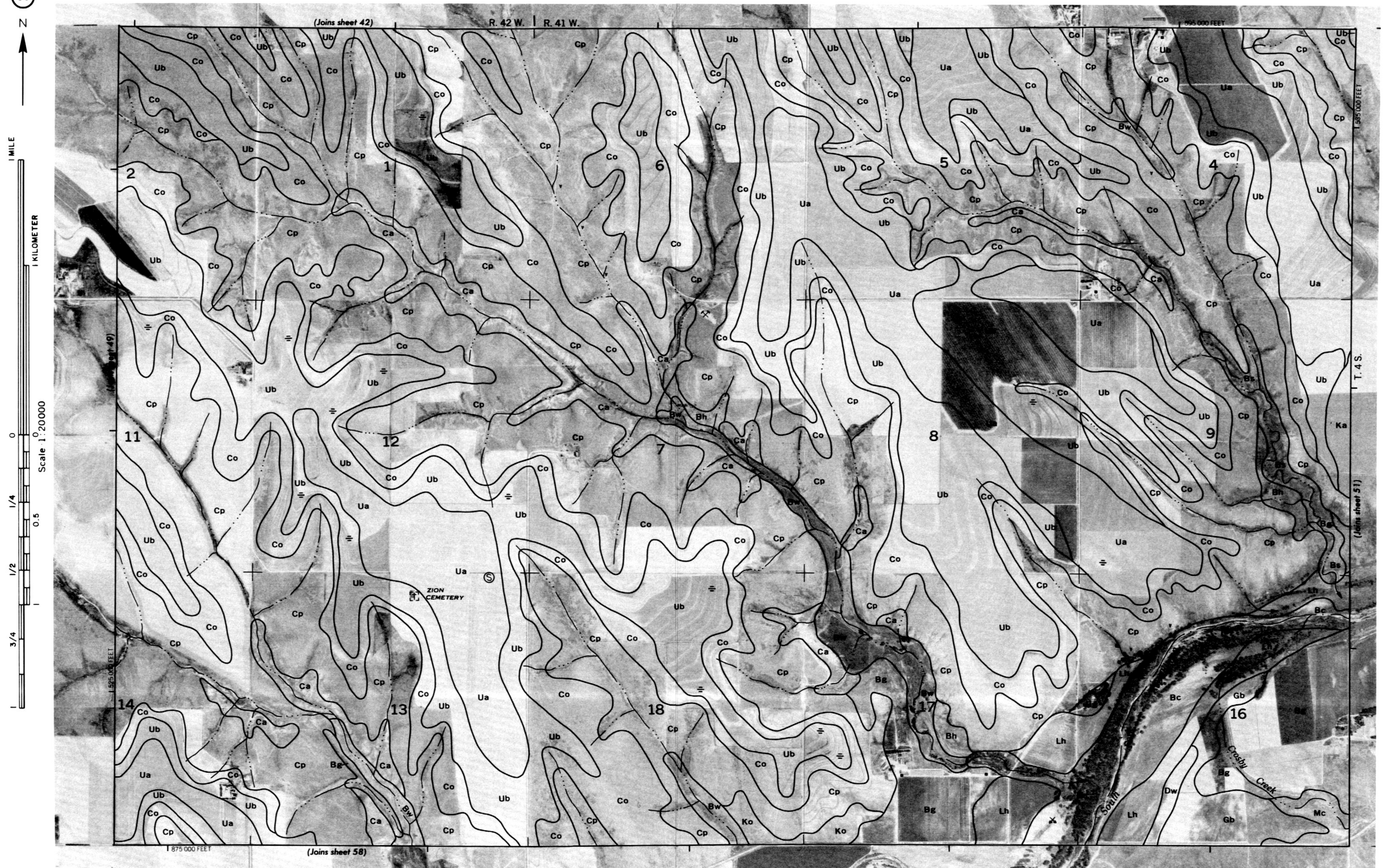

47
N
R. 38 W.
R. 37 W.
(Joins sheet 39)
(Joins sheet 48)
(Joins sheet 55)
(Joins sheet 46)
995 000 FEET
1 015 000 FEET
535 000 FEET
T. 3 S.
BIRD CITY CEMETERY
Bird City
BURLINGTON
NORTHERN
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5

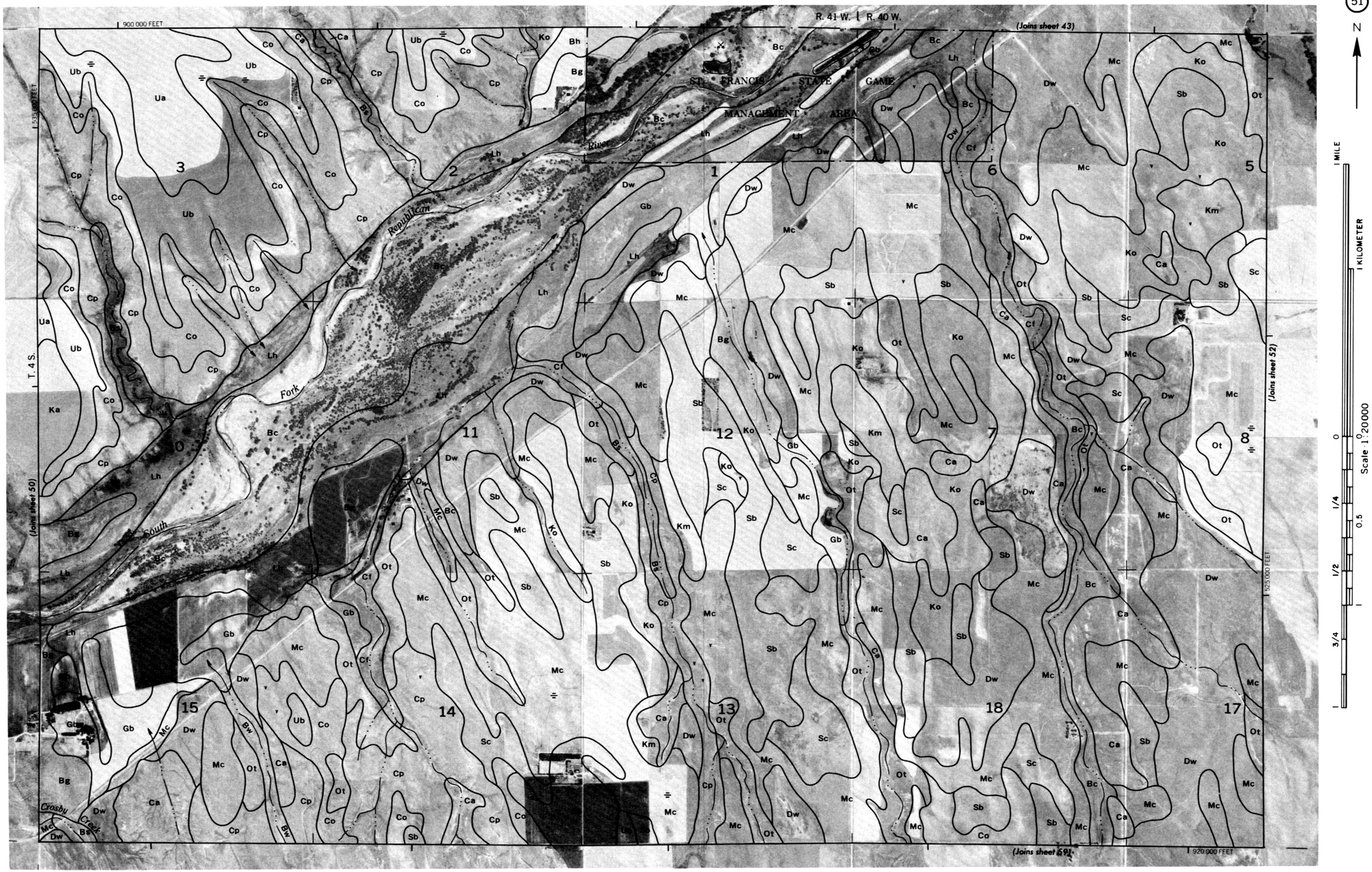
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 48



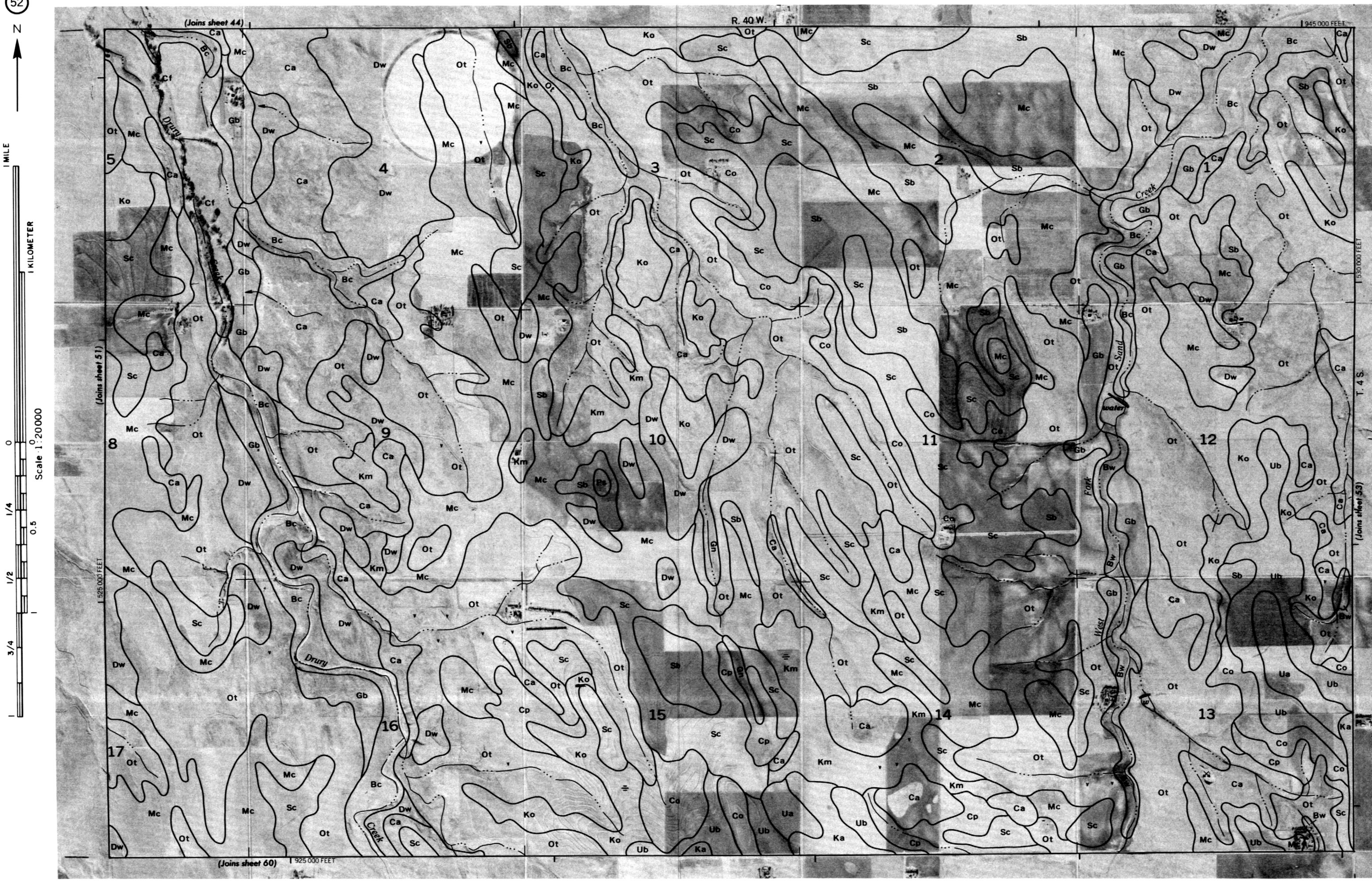
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 49

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 50



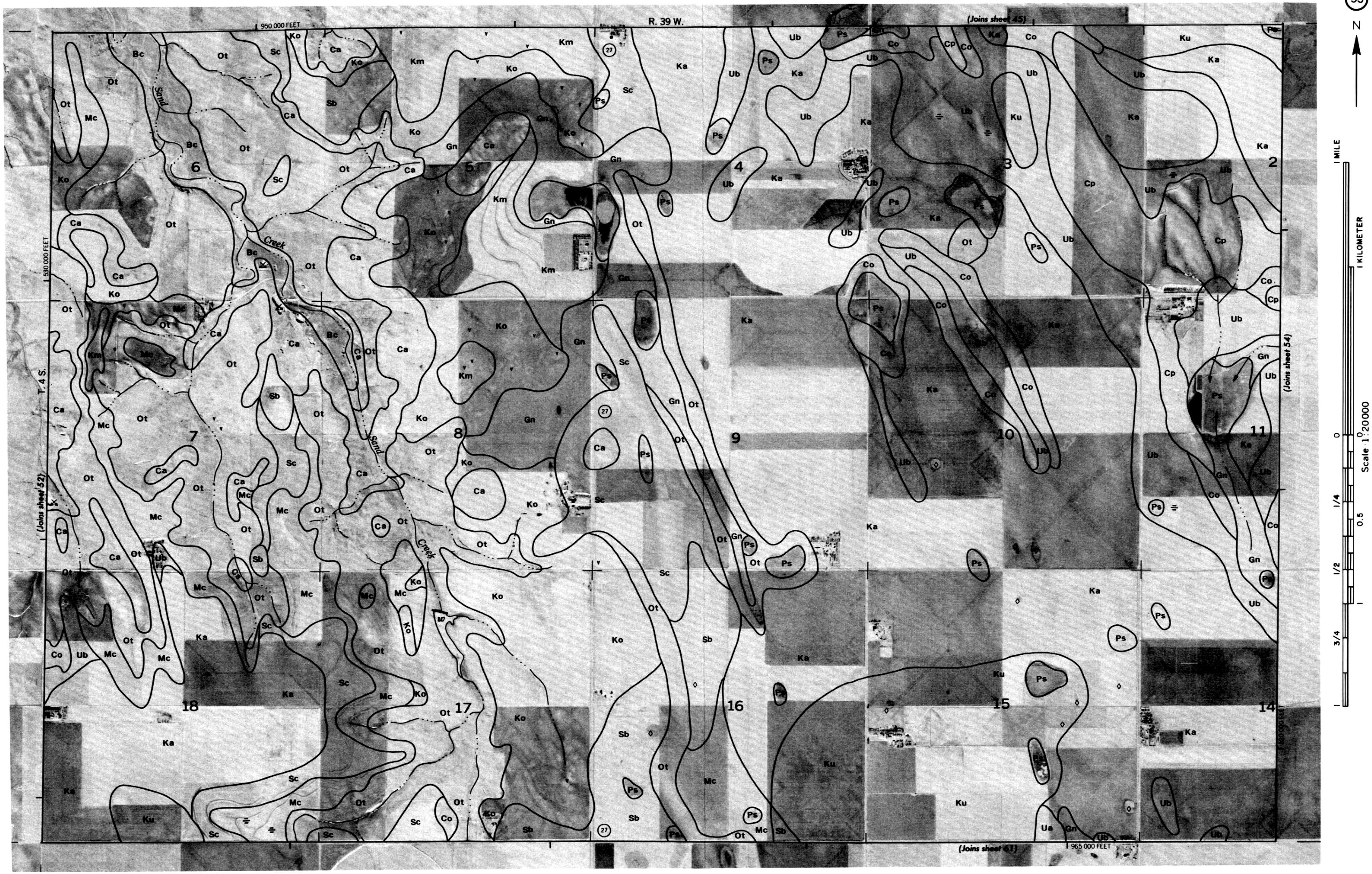

51
N
900 000 FEET
R. 41 W. | R. 40 W.
(Joins sheet 43)
ST. FRANCIS STATE GAME MANAGEMENT AREA
Republican
Fork
South
River
Crosby Creek
T. 4 S.
(Joins sheet 50)
(Joins sheet 52)
(Joins sheet 59)
535 000 FEET
525 000 FEET
920 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 52

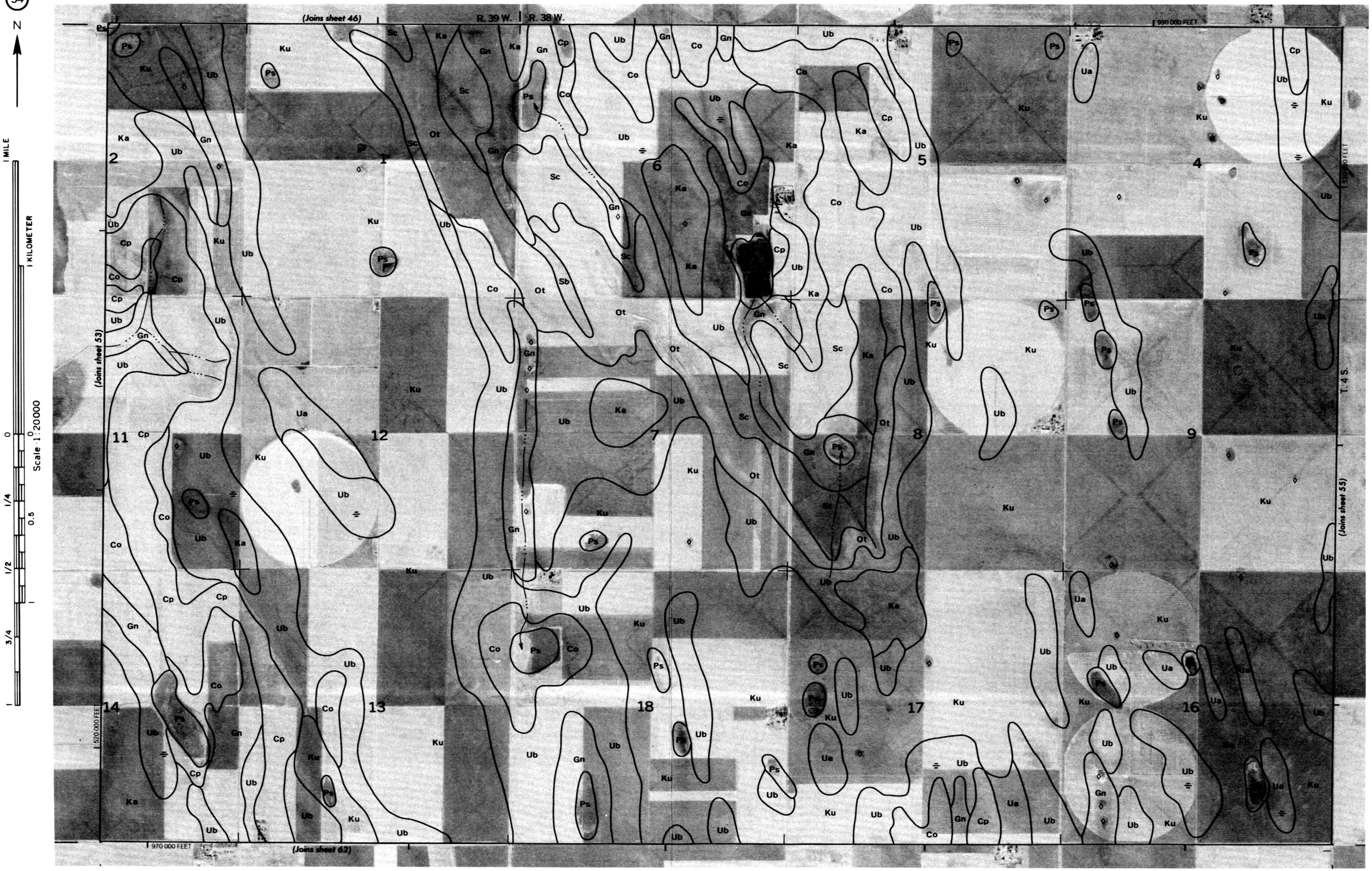


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 53

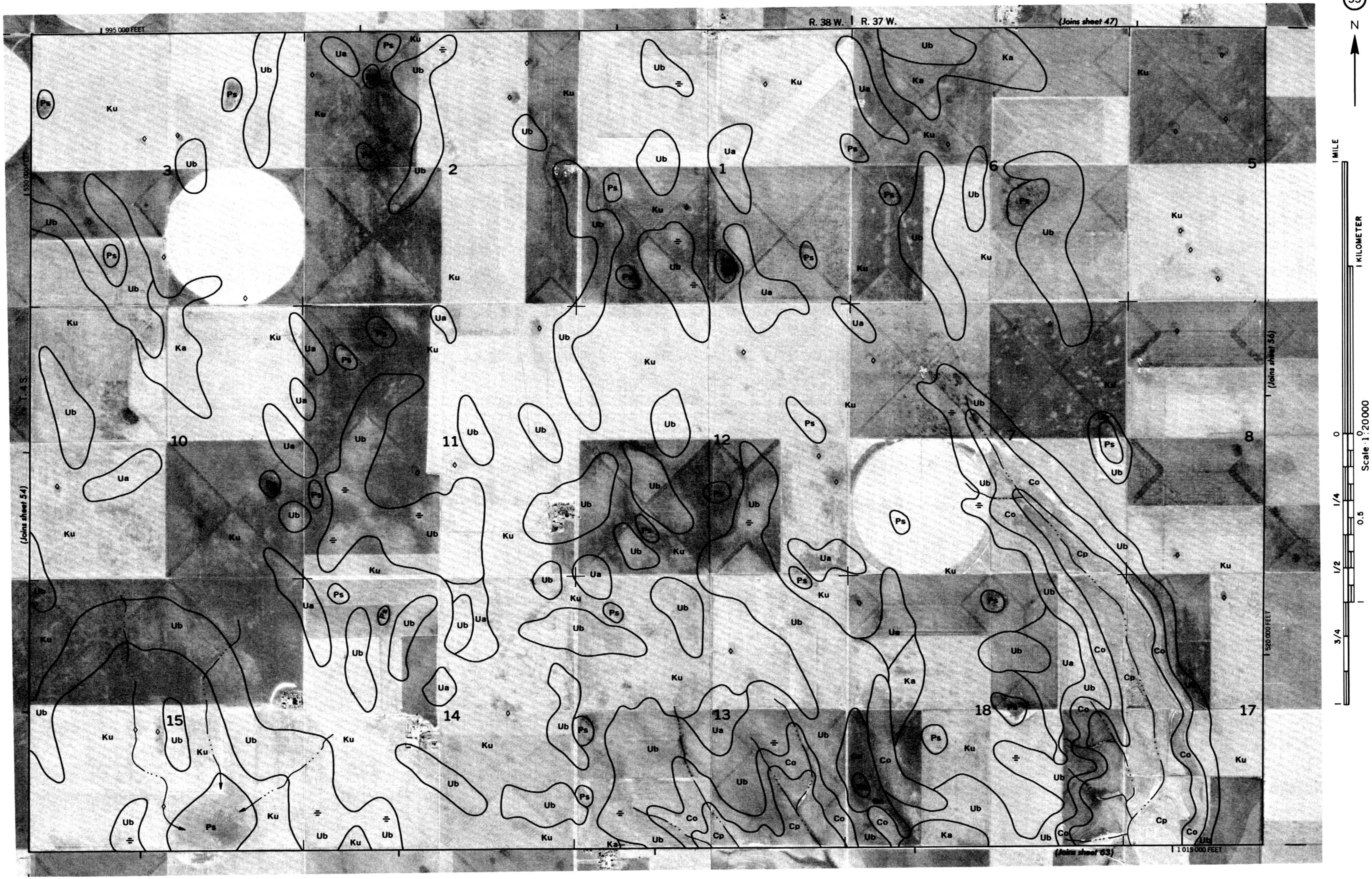
53



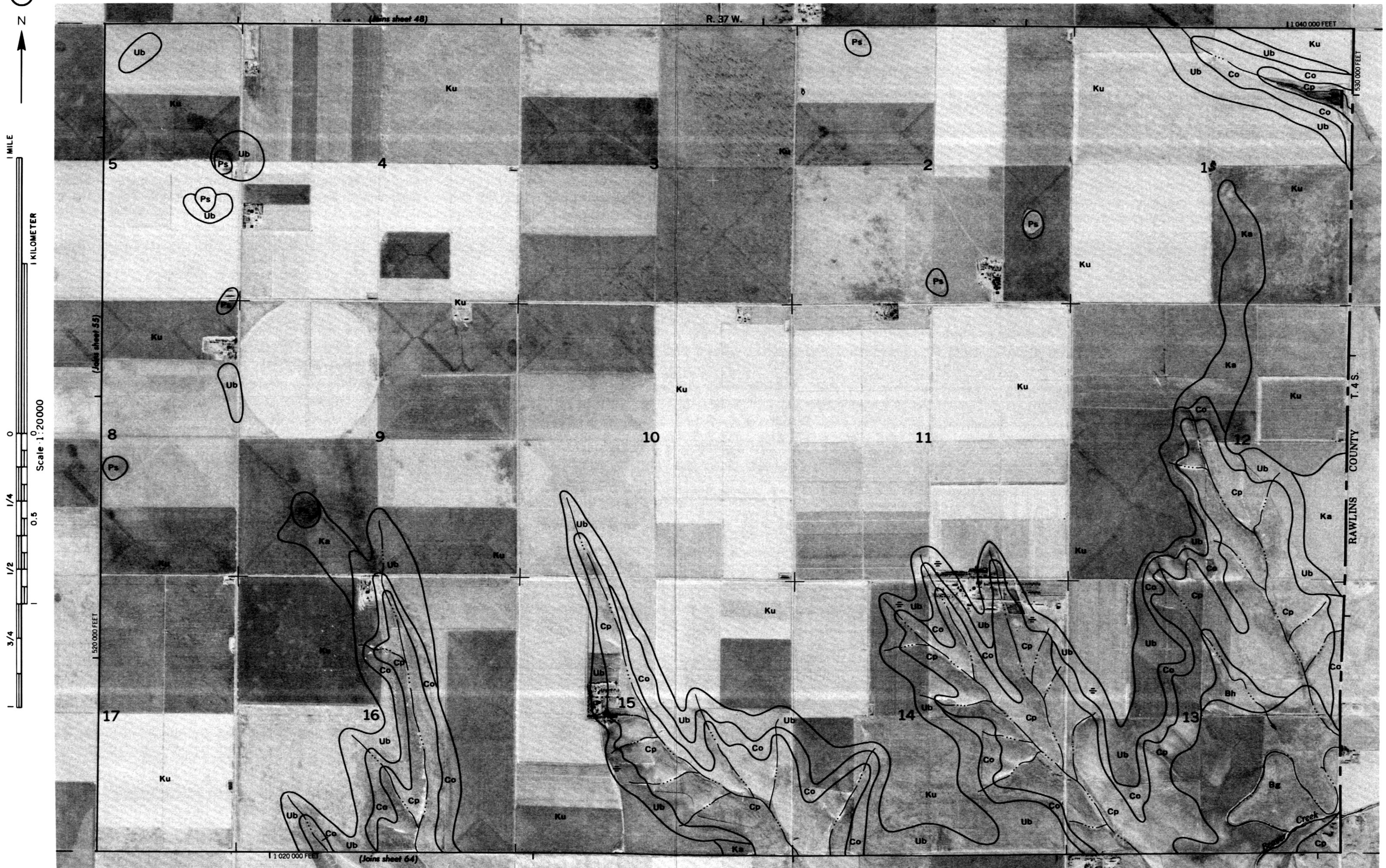
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 54



SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 55

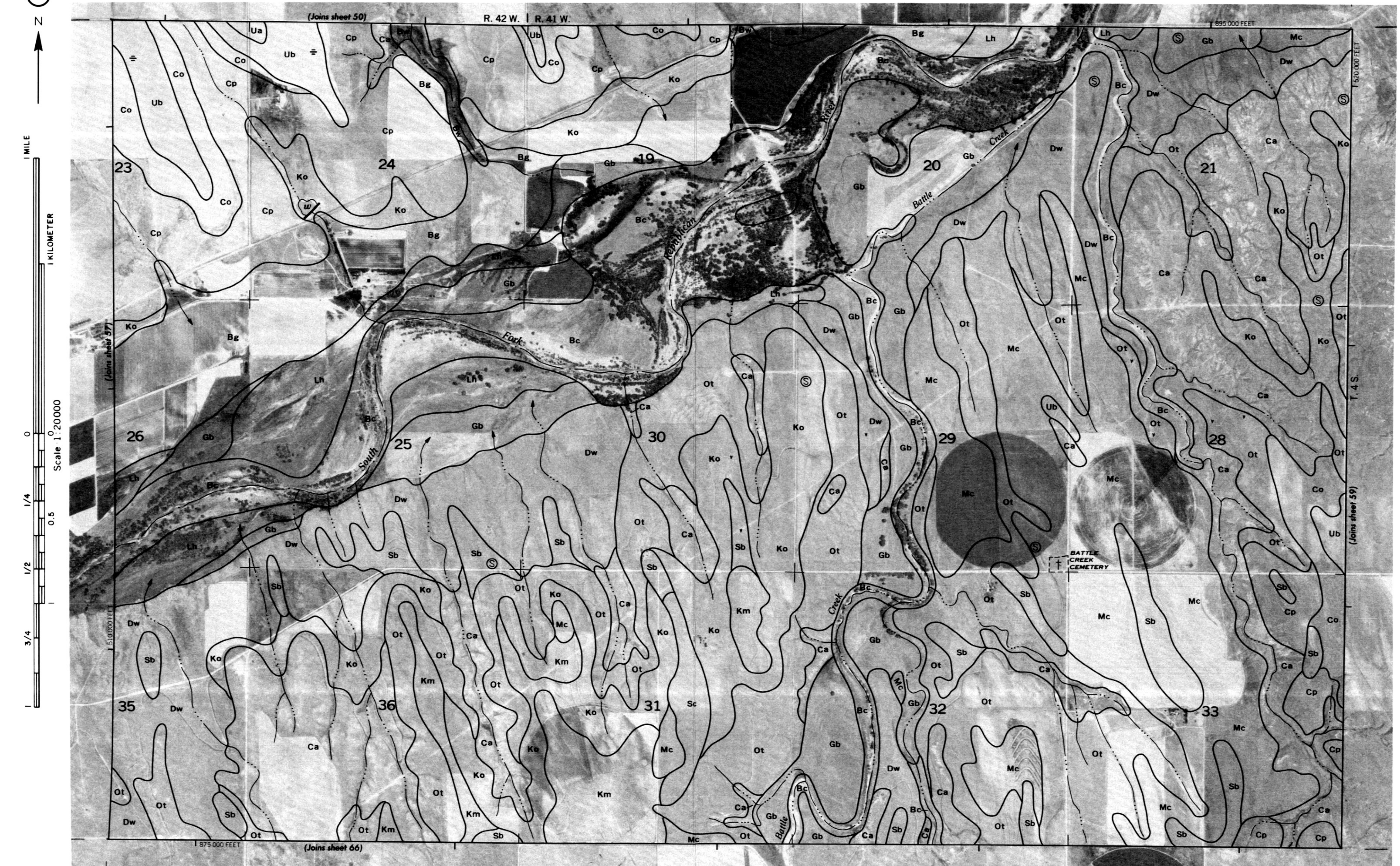


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 56

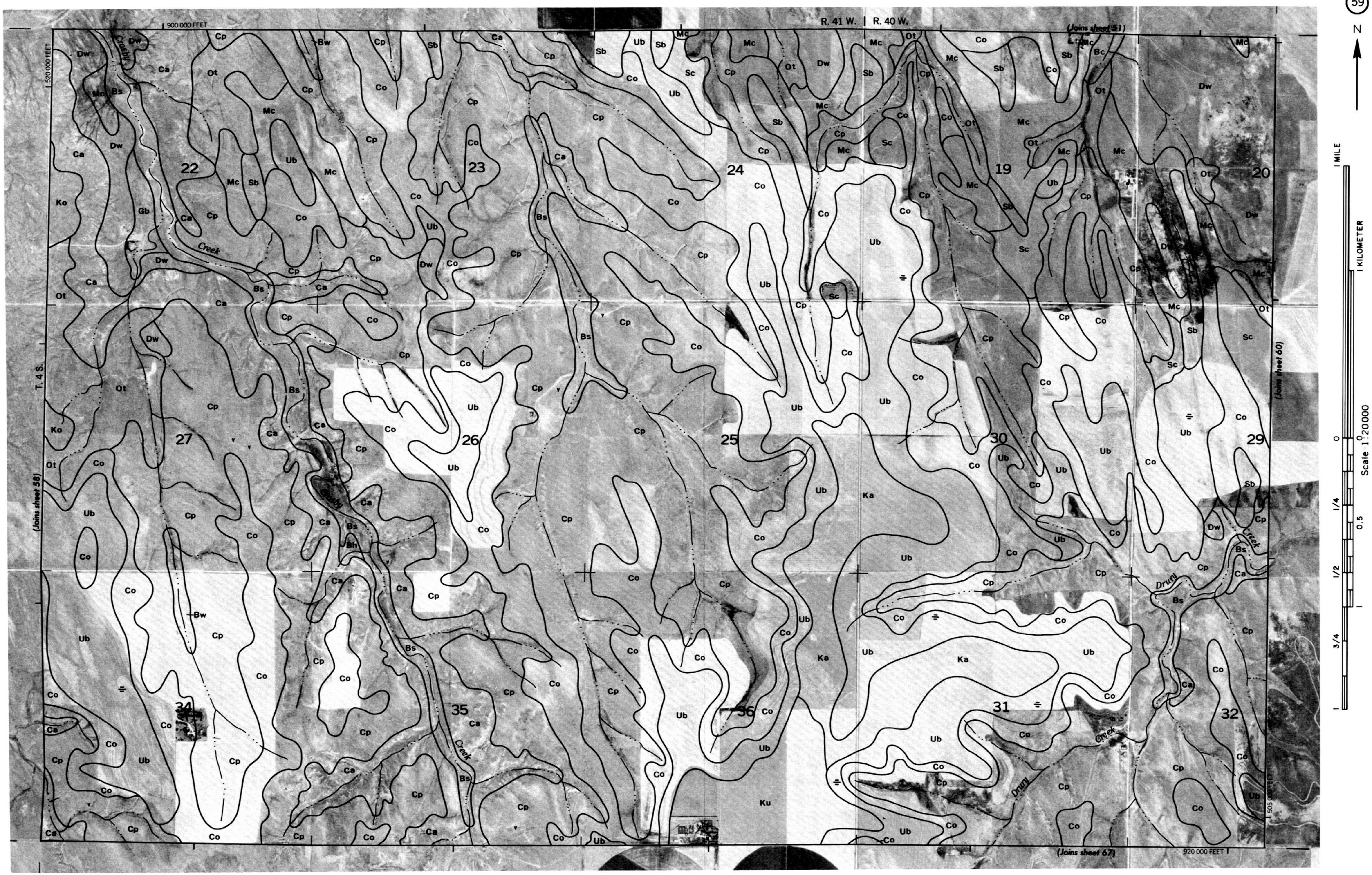


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 57

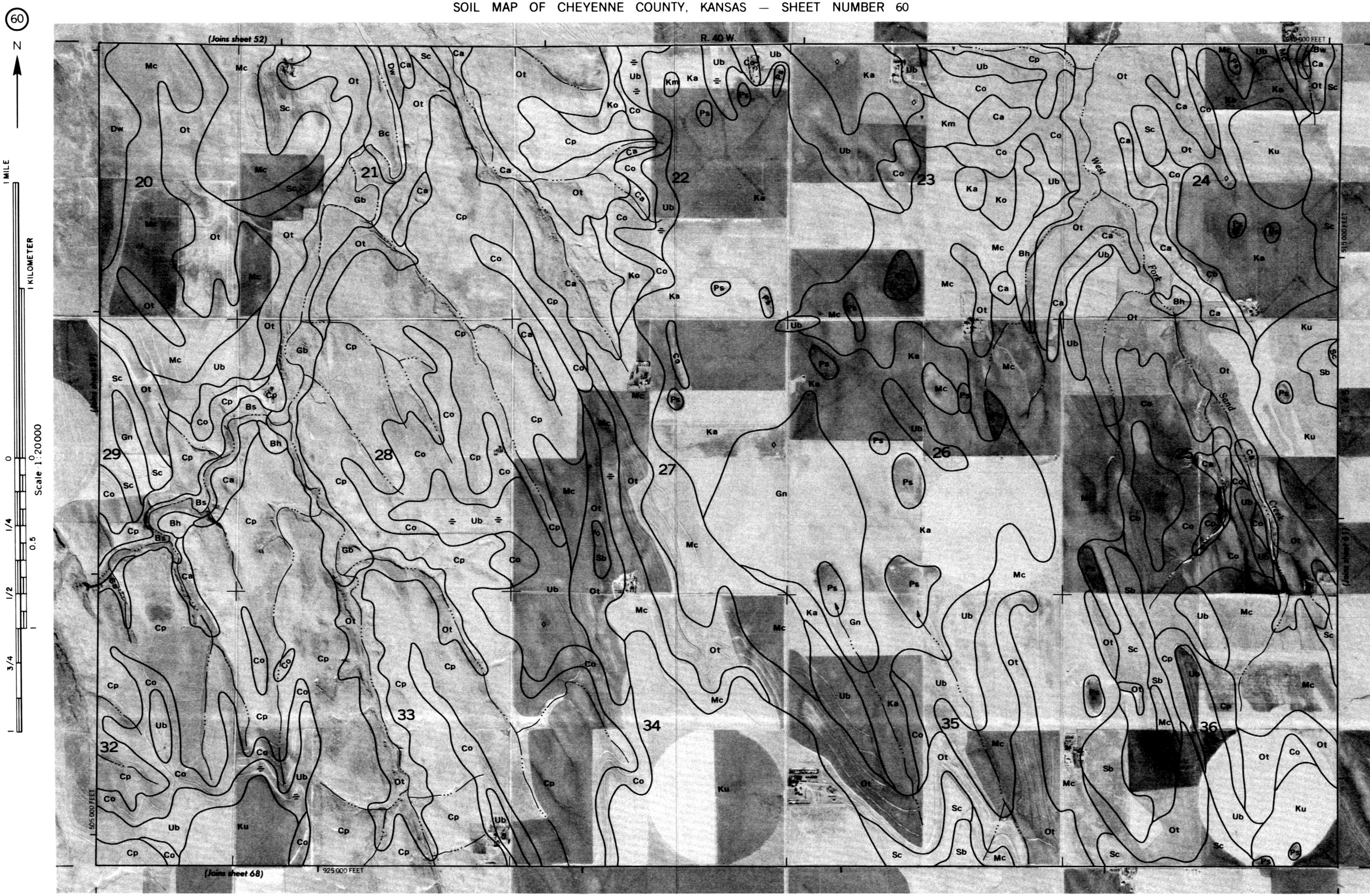
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 58



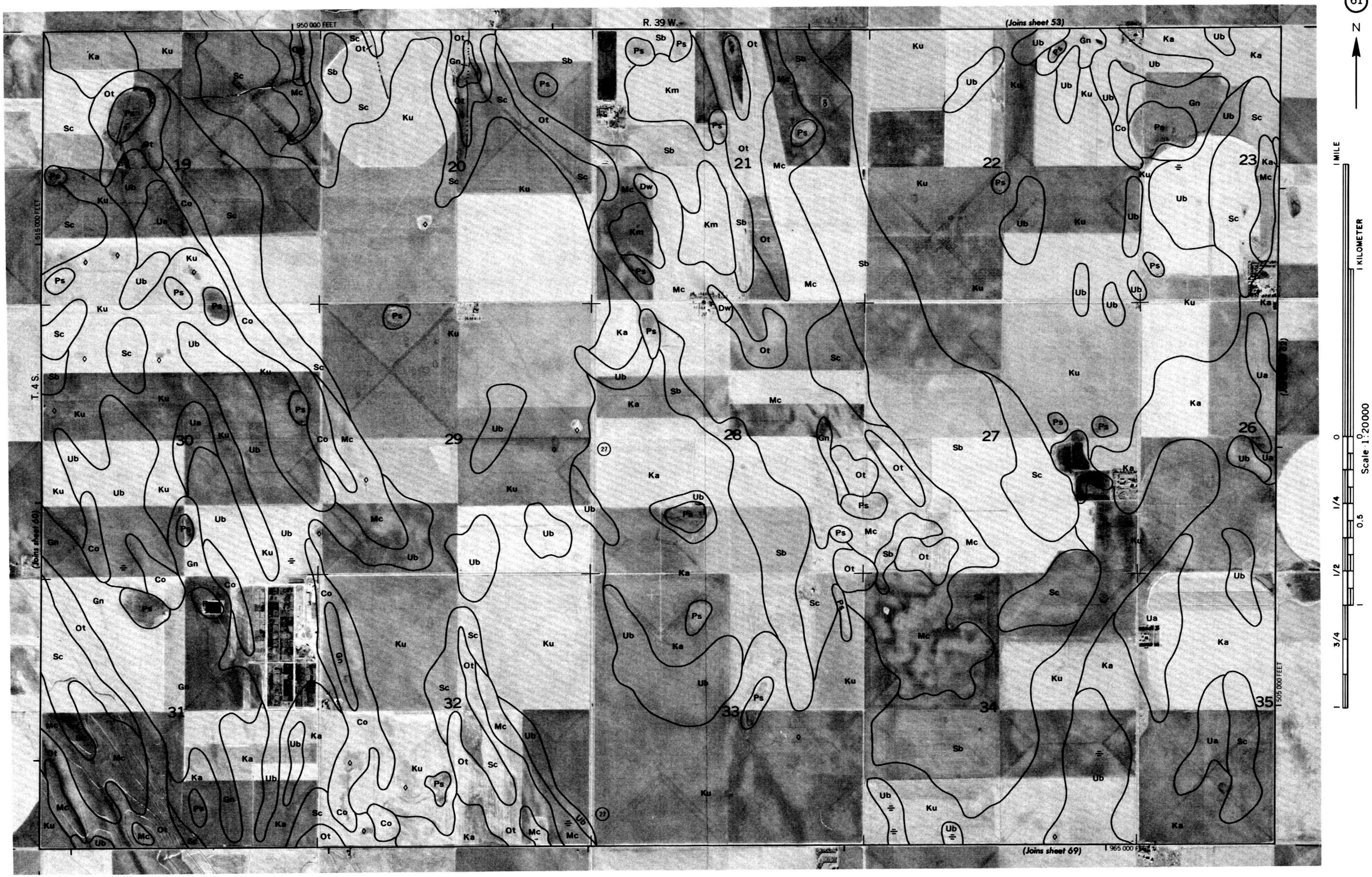
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 59



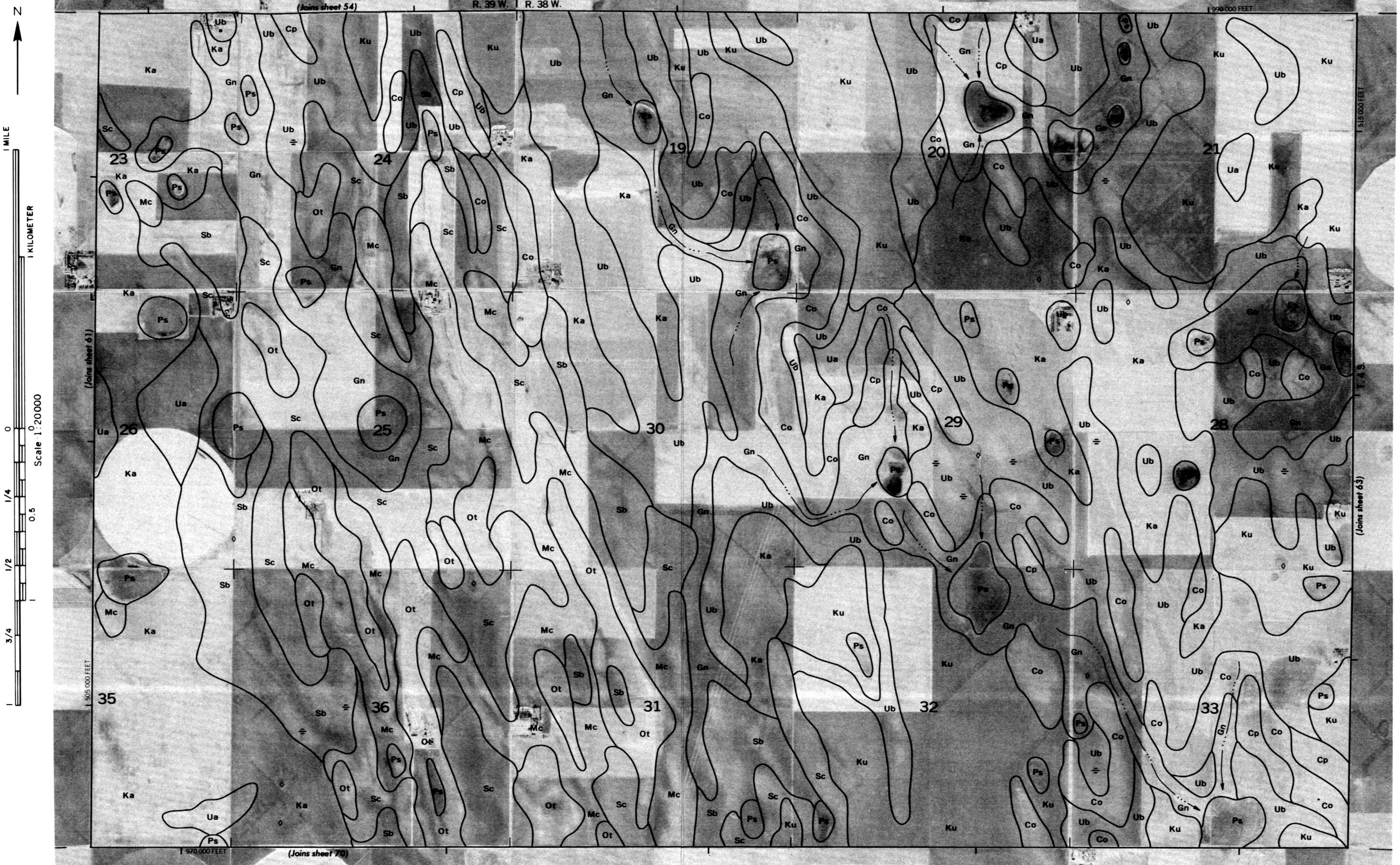
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 60



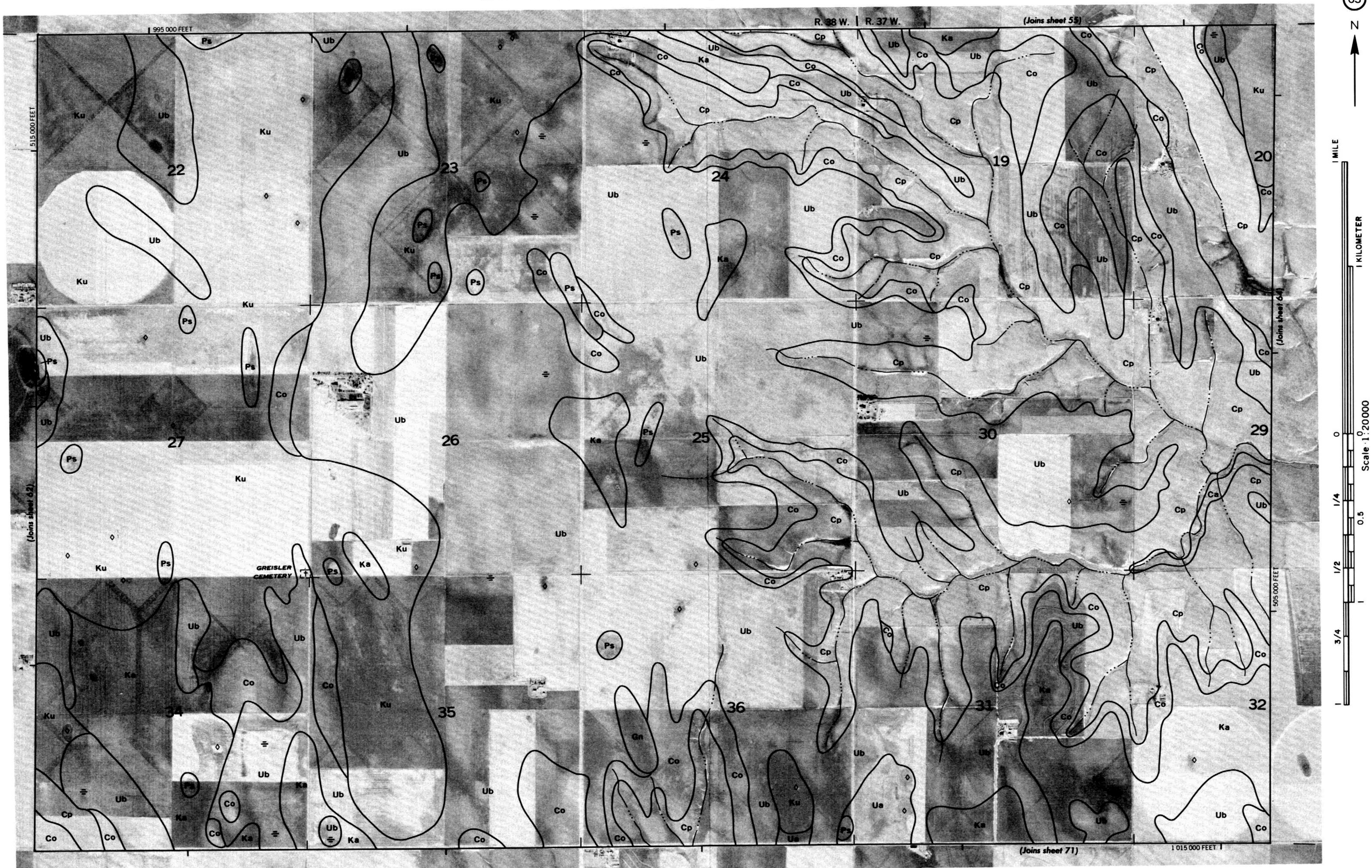
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 61

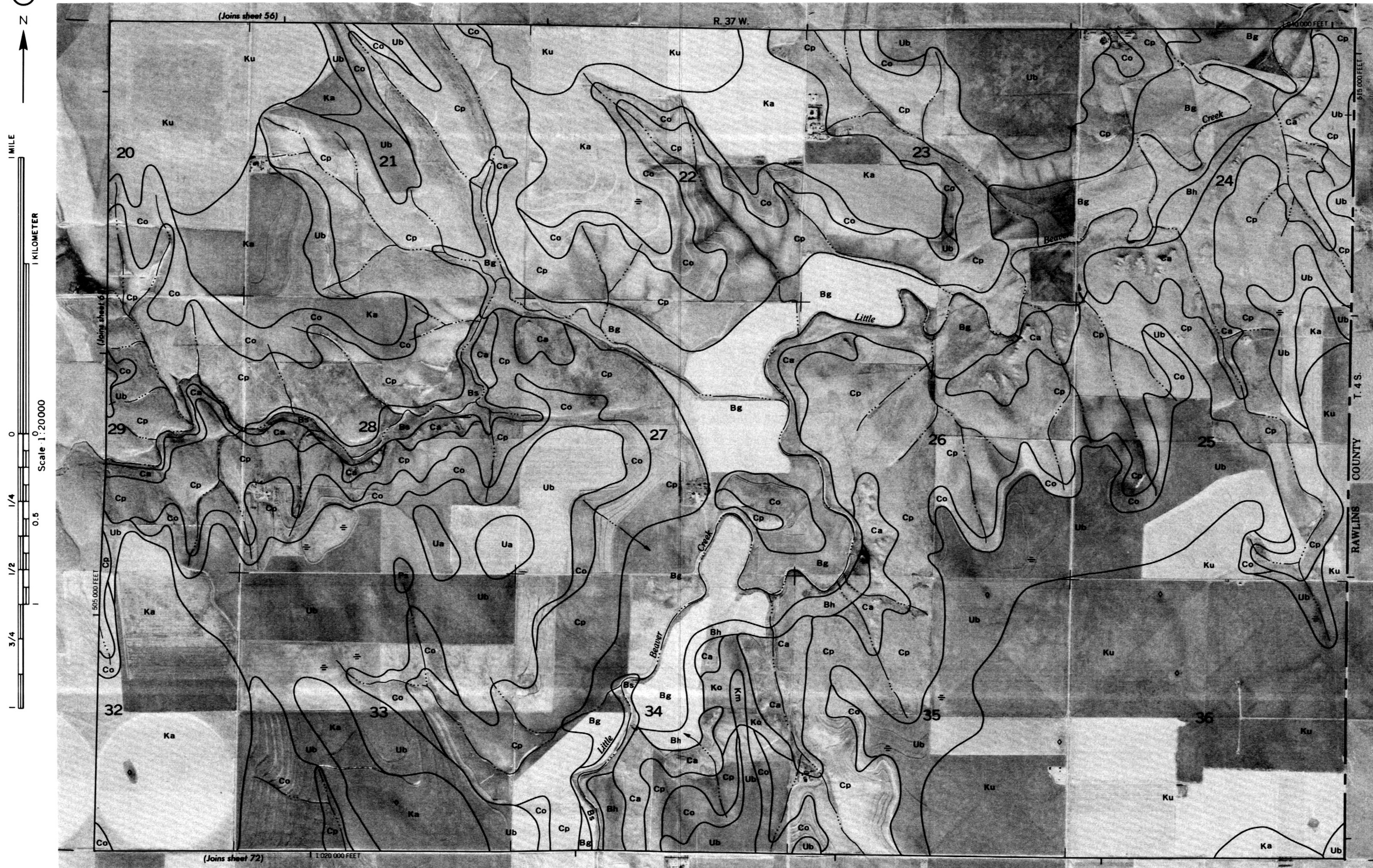


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 62



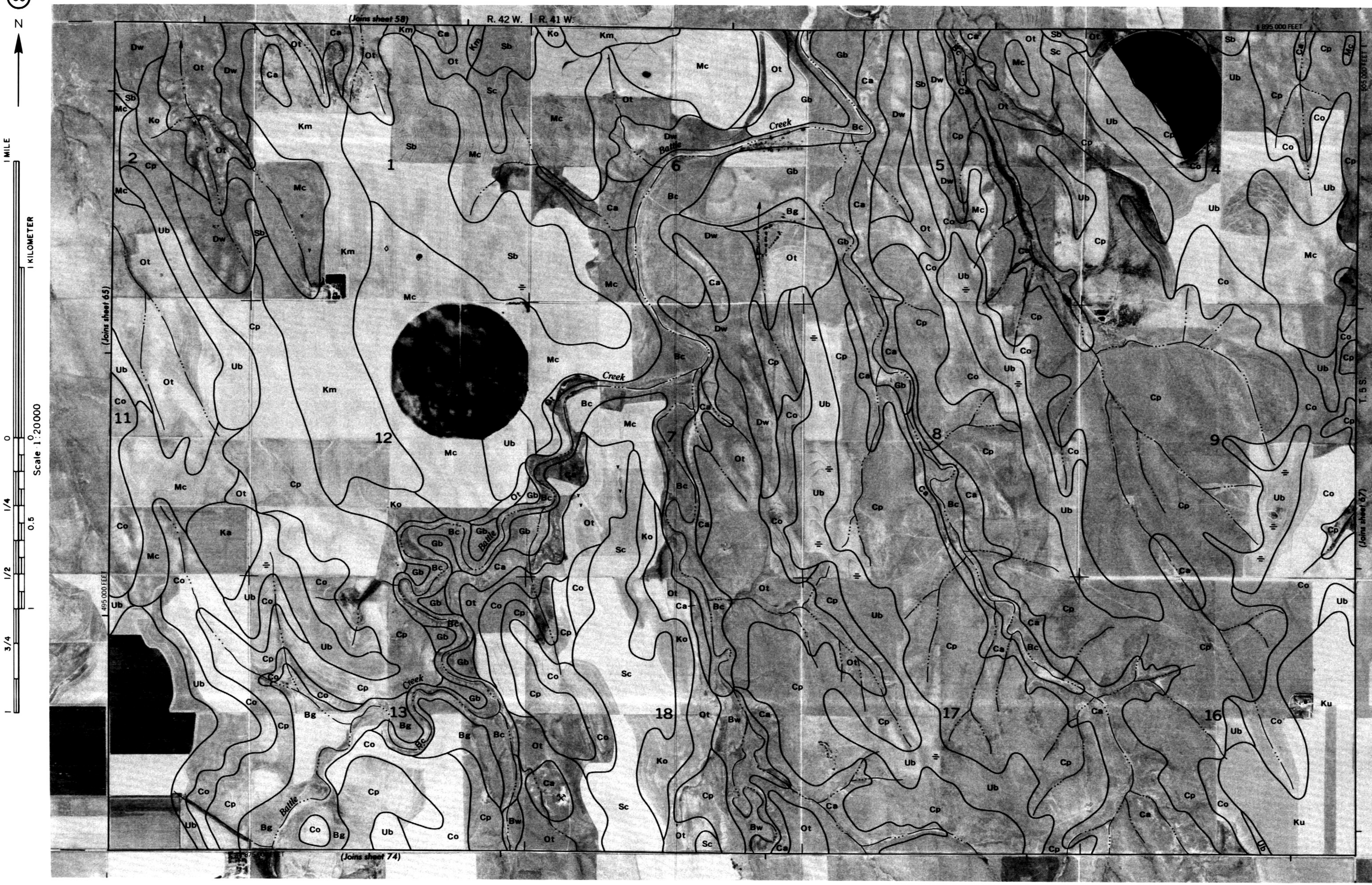
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 63



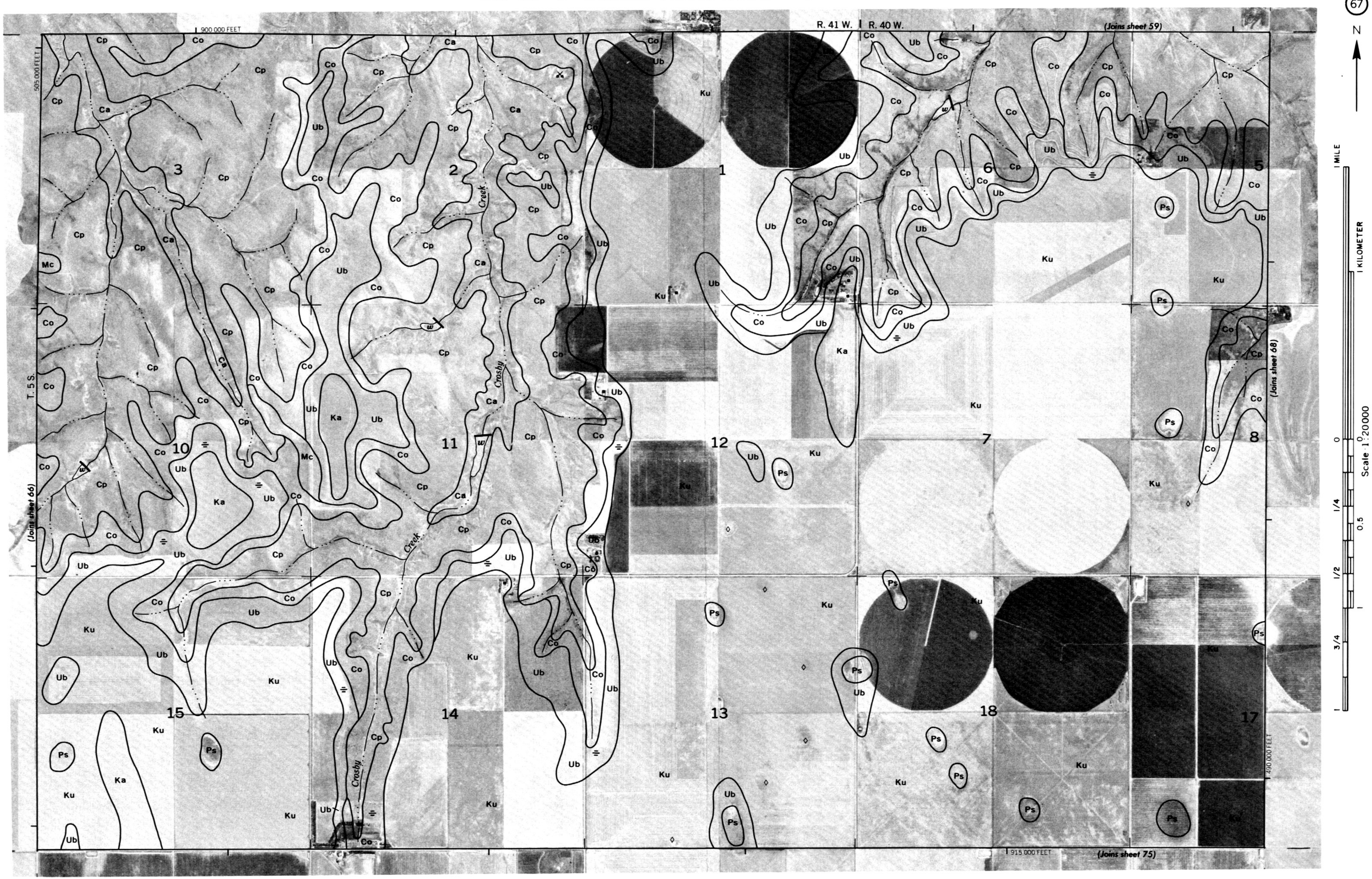

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
(Joins sheet 56)
R. 37 W.
(Joins sheet 64)
(Joins sheet 72)
505 000 FEET
515 000 FEET
1 020 000 FEET
1 030 000 FEET
T. 4 S.
RAWLINS COUNTY
Beaver Creek
Little Beaver Creek
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 65

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 66

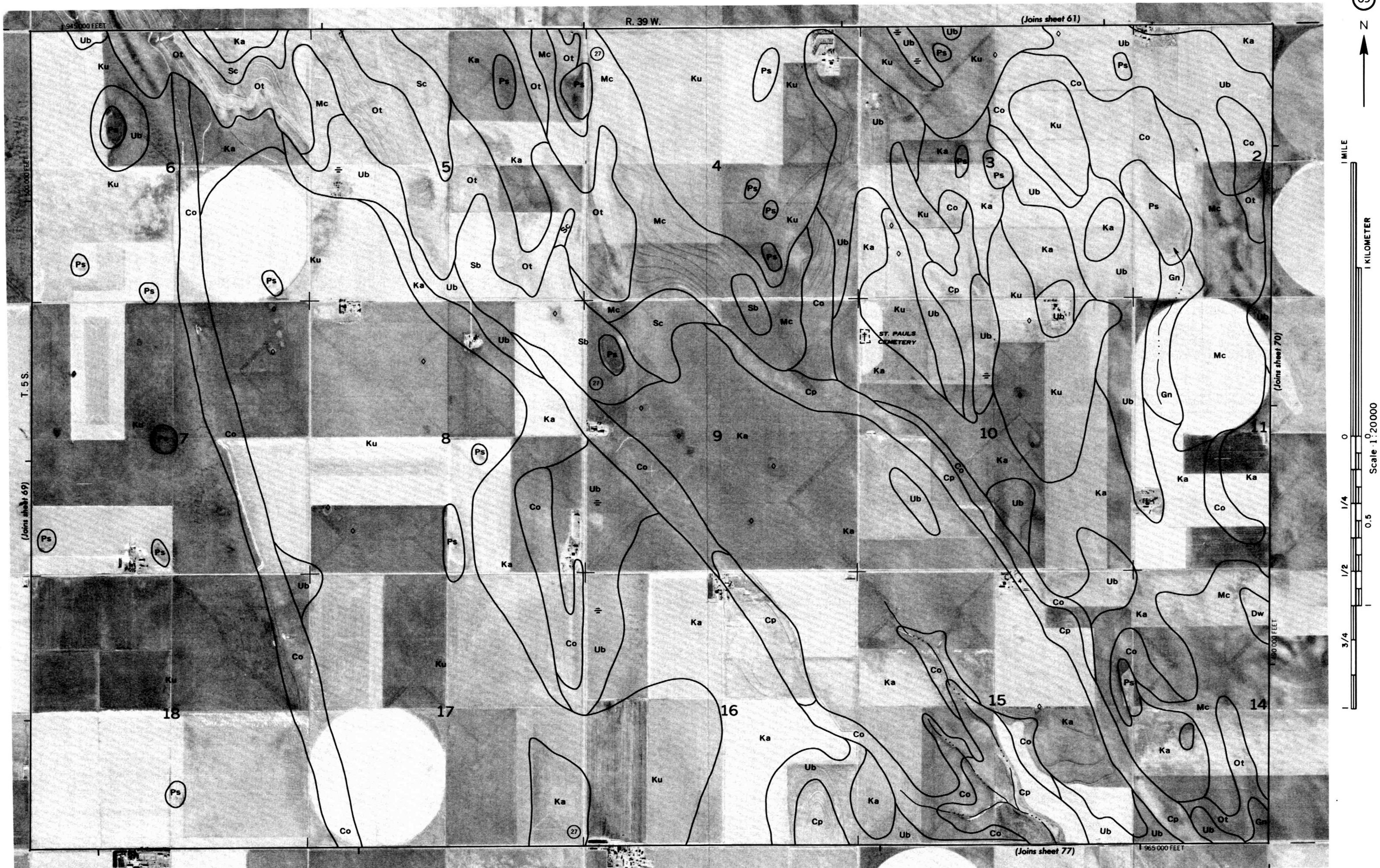


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 67

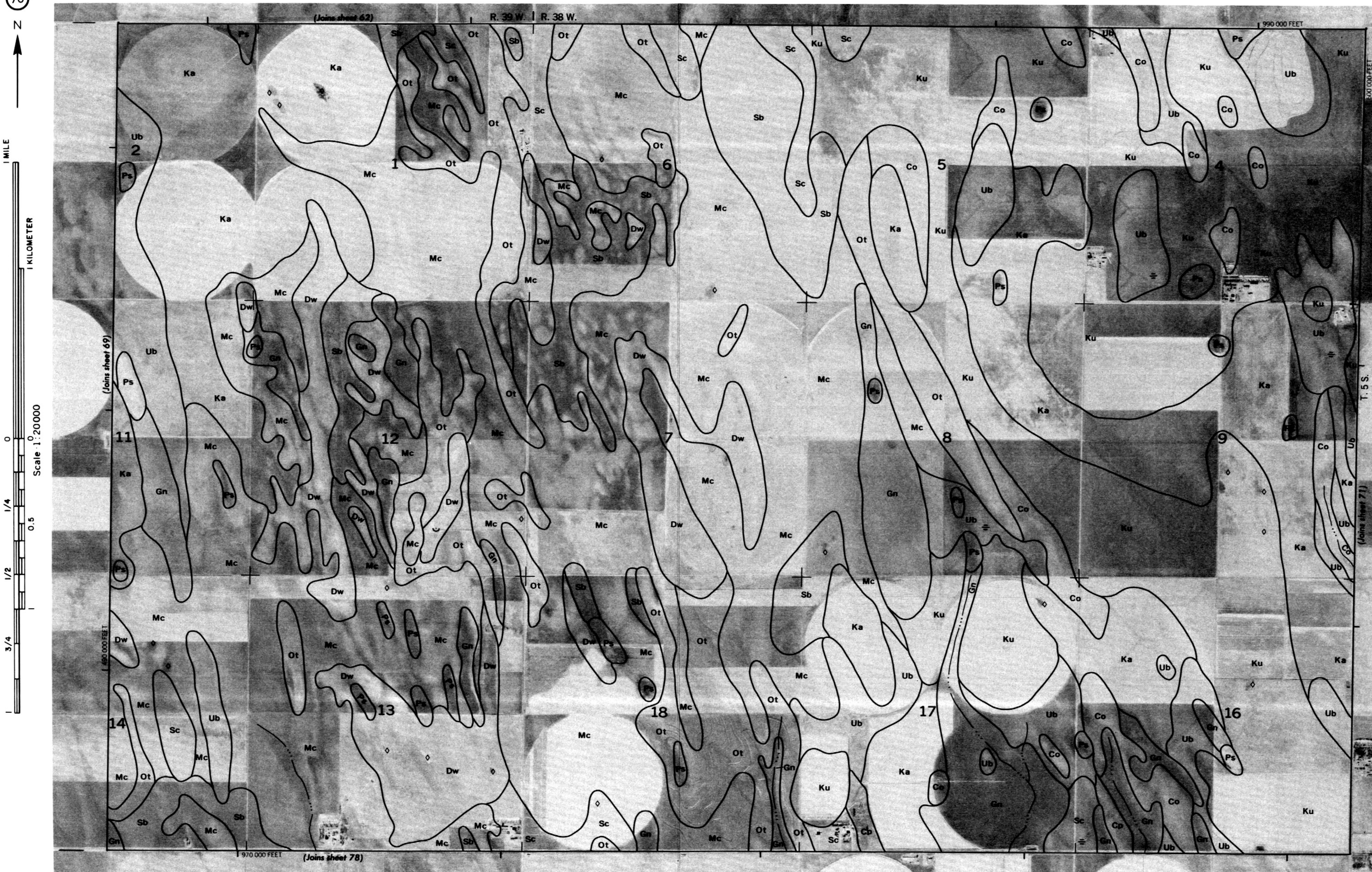


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 68

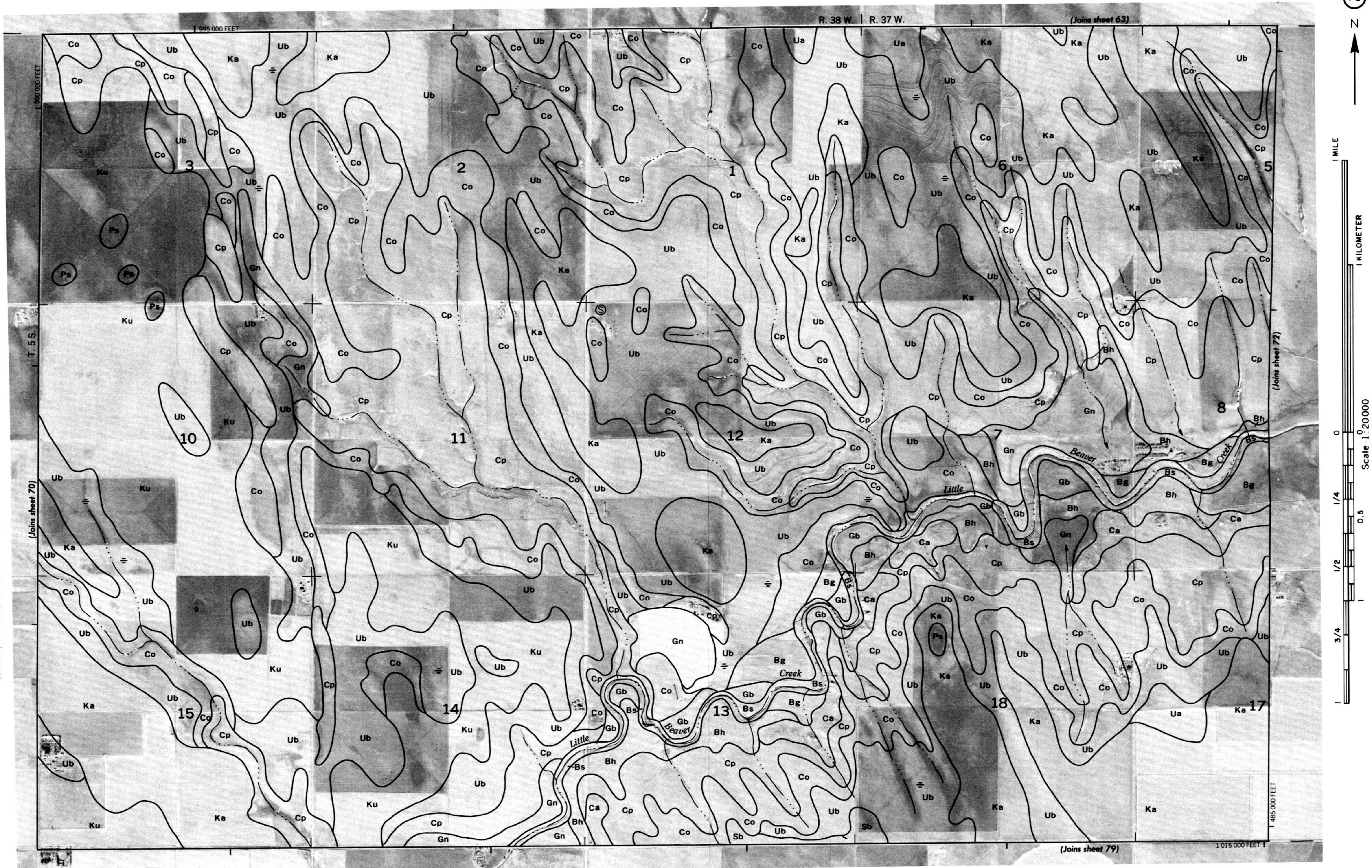
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 69



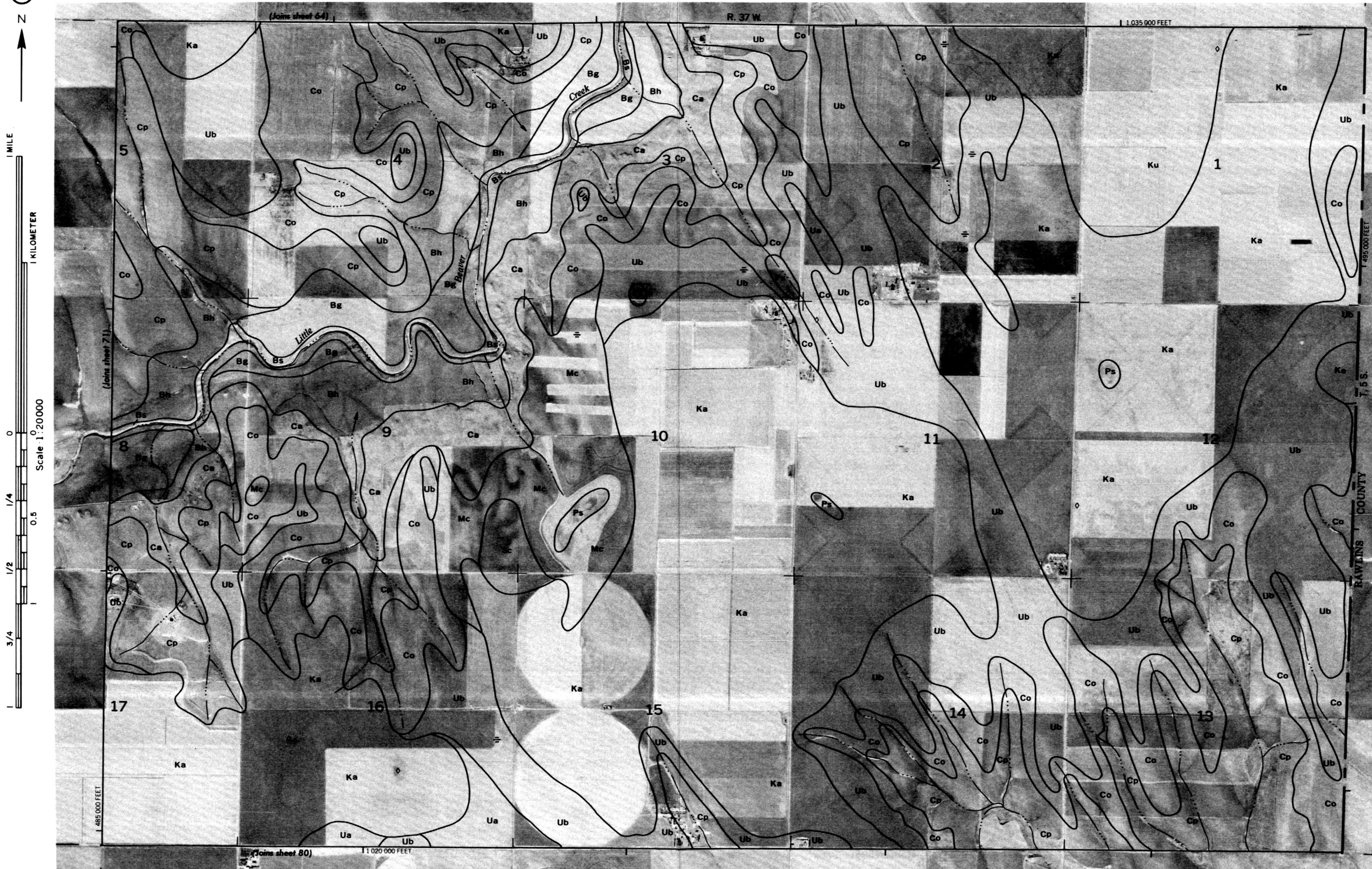
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 70

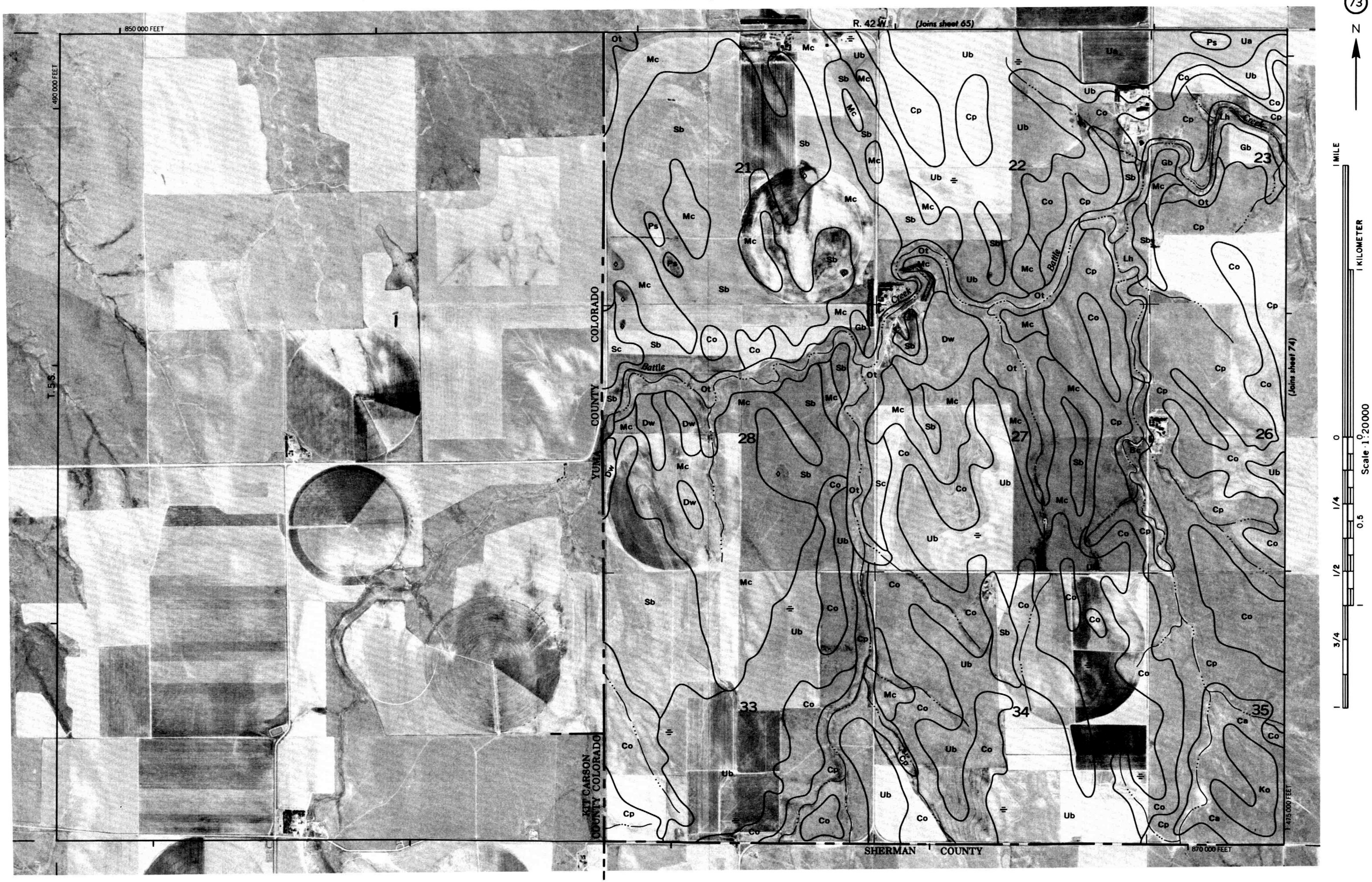


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 71

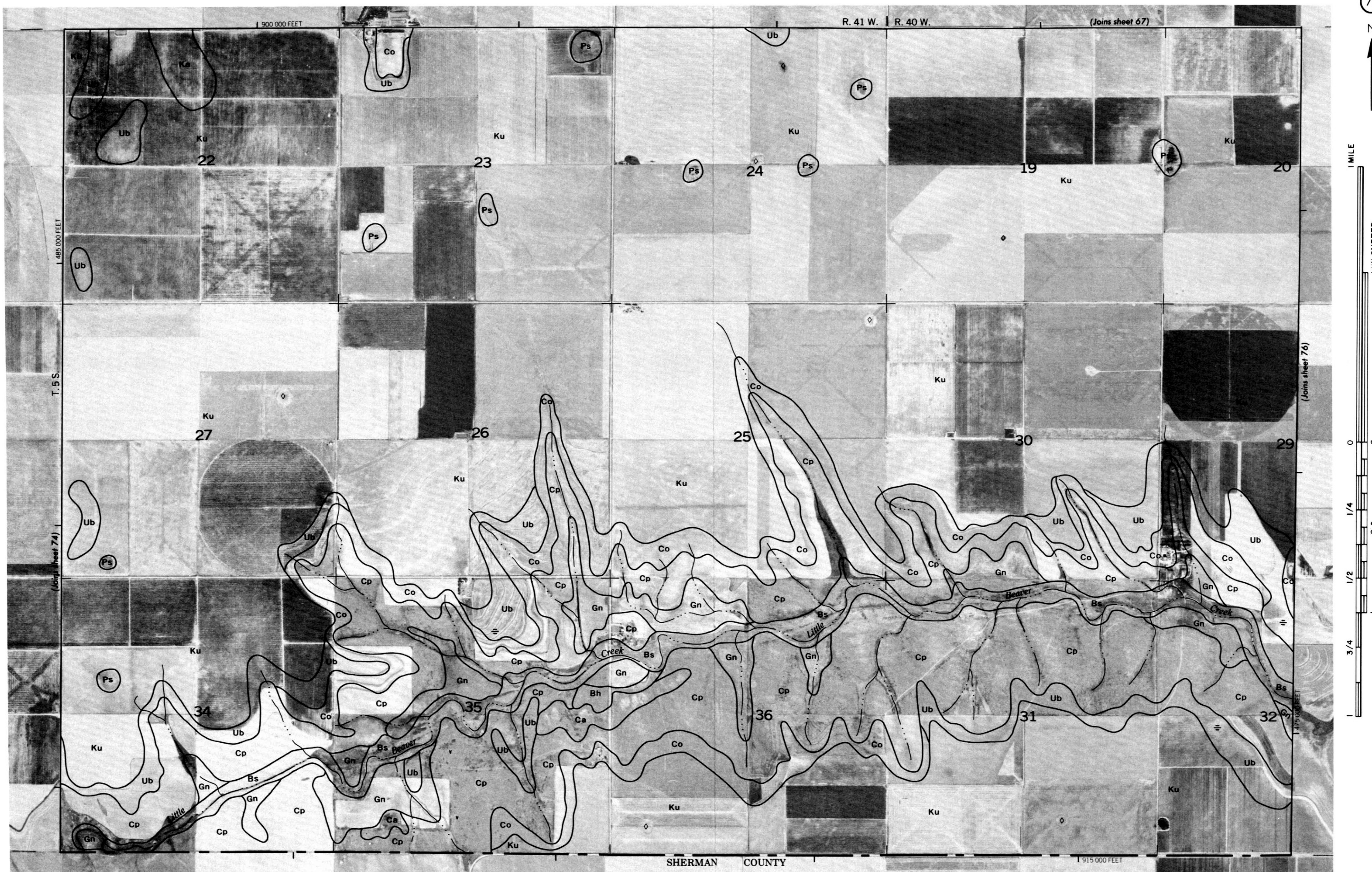


SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 72



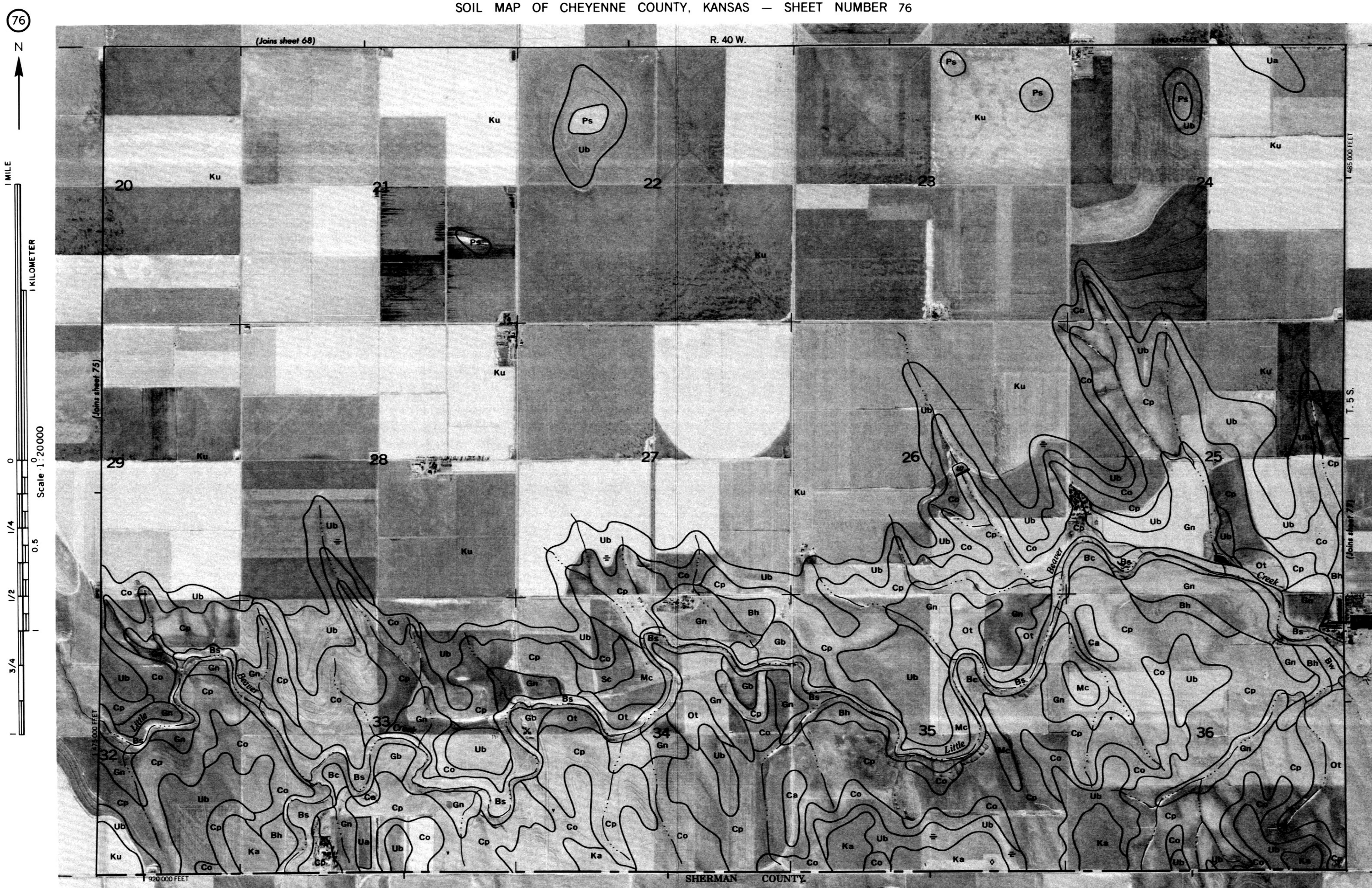

73
N
850 000 FEET
490 000 FEET
R. 42 W.
(Joins sheet 65)
(Joins sheet 74)
T. 5 S.
COLORADO
YUMA COUNTY
KIT CARSON COUNTY COLORADO
SHERMAN COUNTY
870 000 FEET
475 000 FEET
Battle Creek
21
22
23
26
27
28
33
34
35
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 74



75
N
900 000 FEET
R. 41 W.
R. 40 W.
(Joins sheet 67)
485 000 FEET
T. 5 S.
(Joins sheet 74)
(Joins sheet 76)
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
Ku
Ub
Co
Ps
Cp
Gn
Bs
Bh
Ca
Little
Beaver
Creek
SHERMAN
COUNTY
915 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5

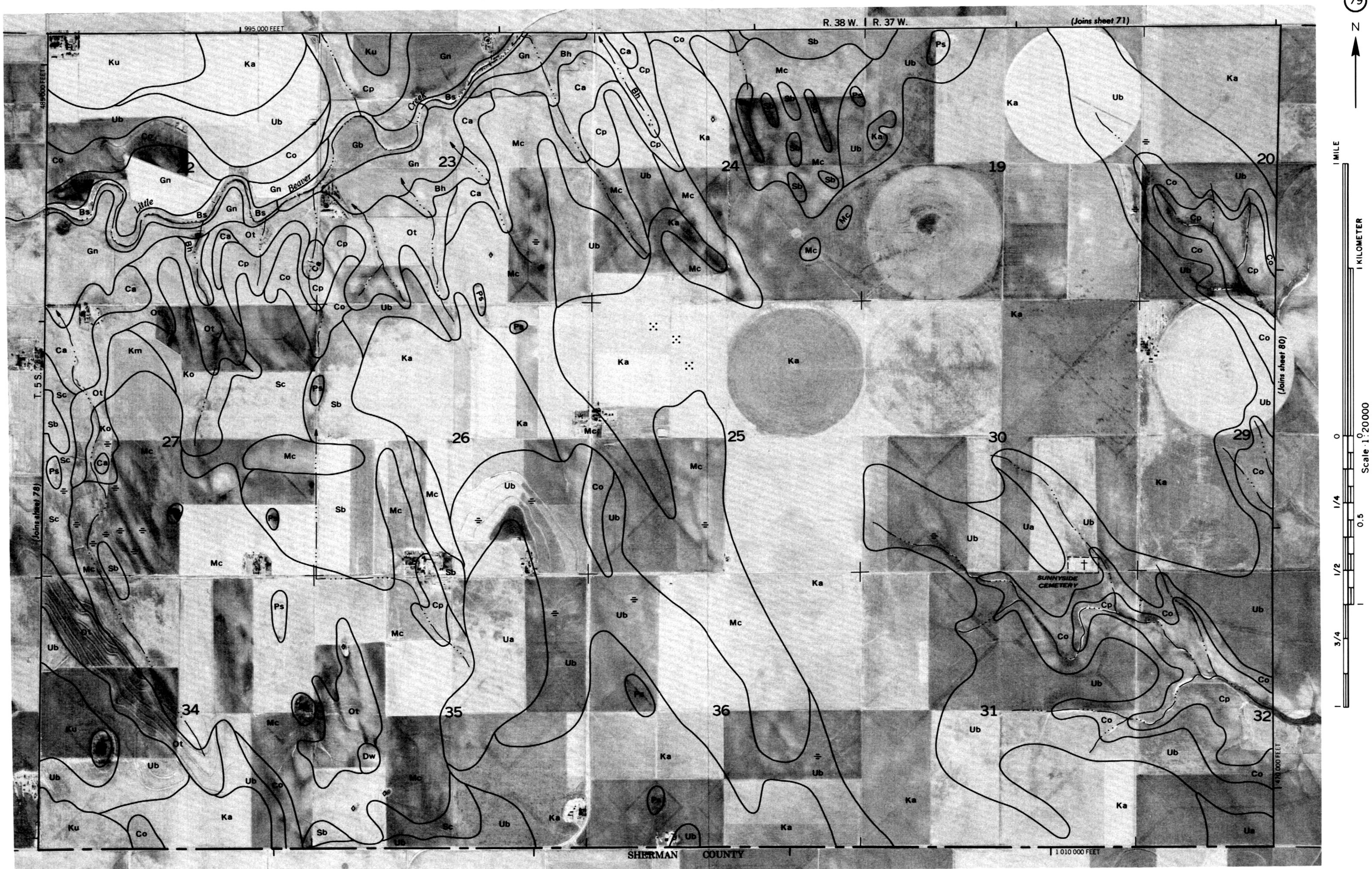
SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 76



SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 77

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 78

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 79



(80)

SOIL MAP OF CHEYENNE COUNTY, KANSAS — SHEET NUMBER 80